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Railway Age

DAILY EDITION

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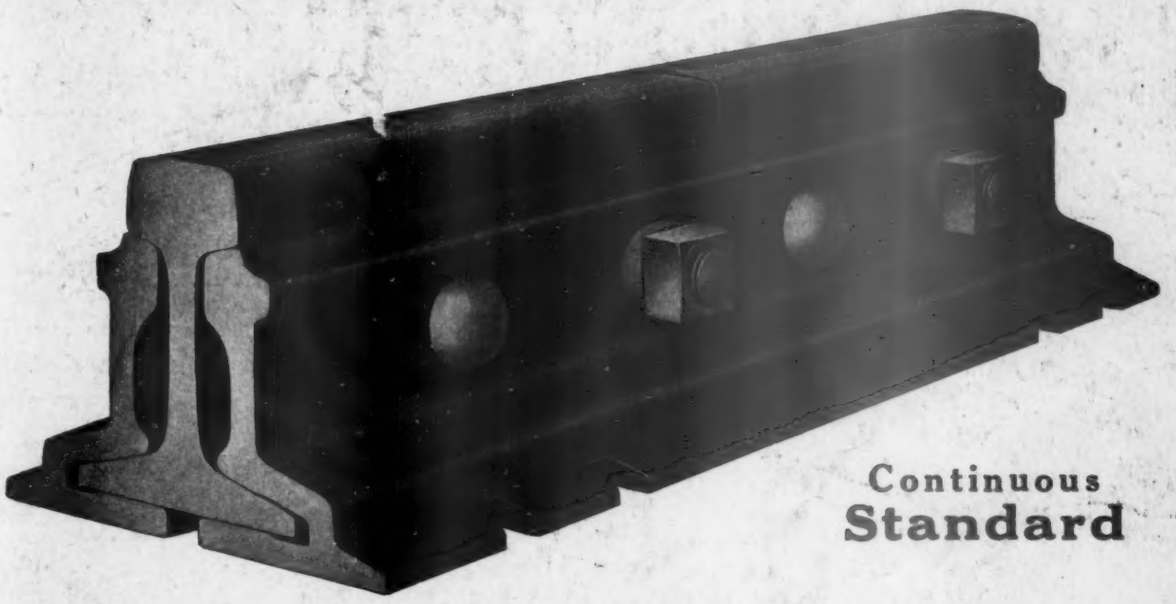

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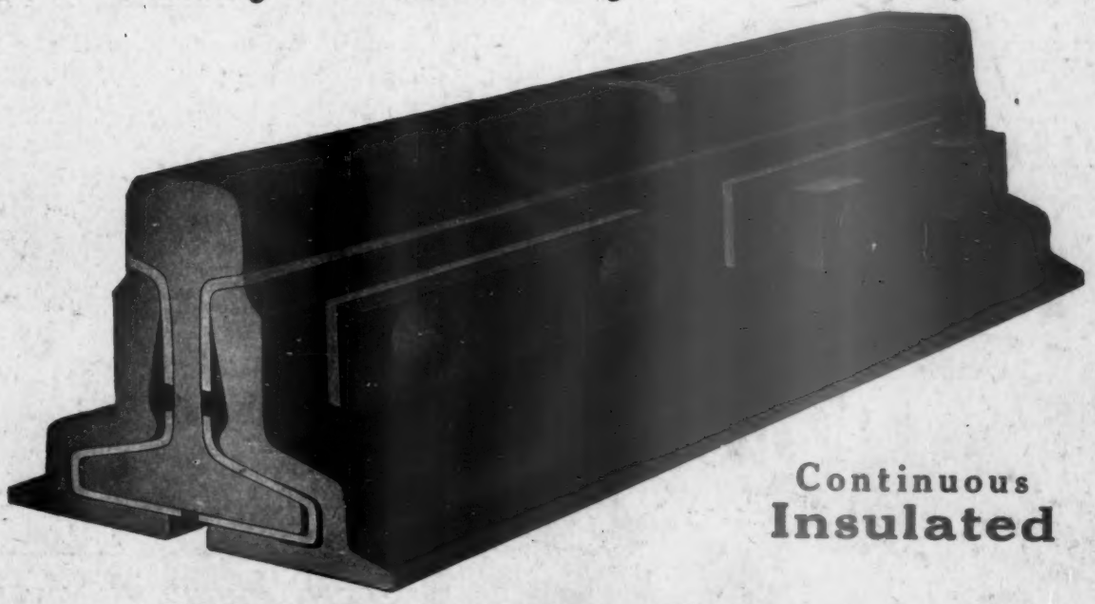

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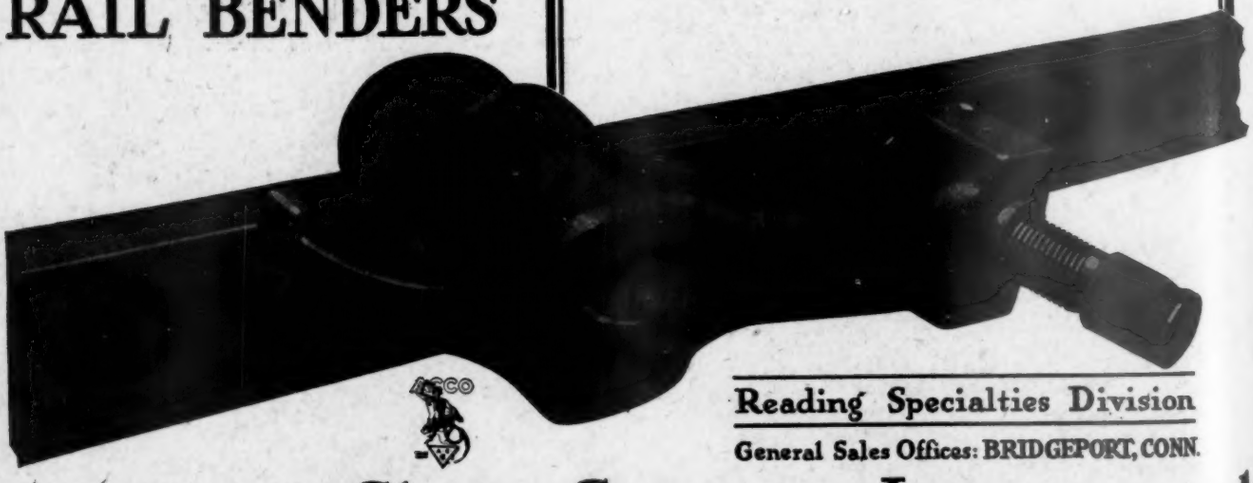

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EDITORIAL

Railway Age

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Signal Section Attendance

The attendance at the first annual meeting of the Signal section to be held in March was the largest in the history of the Association. While some felt that is was a mistake to hold a March meeting in Chicago because of the diversity of interest, the attendance record proves that this fear was unfounded. The large attendance is accounted for by the fact that this is the annual meeting of the section, that the exhibit of the National Railway Appliances Association is being held at the same time and that many of the troubles incident to the shopmen's strike have been cleared up, thus giving many signal officers an opportunity to attend the meeting this year, when they were unable to attend meetings held last year. One noticeable feature of the attendance at this meeting is the fact that few of the younger signal men and subordinate officers were present, because it appears that many of the railroads had the feeling that this was a needless expense. This is a short-sighted policy on the part of railroad managements, because the younger men would have an opportunity to obtain information in connection with their daily work, not only on the convention floor, but at the railway exhibit and in conversation with others outside the meeting, which would return to the roads in efficient and better service many times the amounts that they would be required to spend to send these men to the meeting. The public is looking to the railroads to increase the efficiency of railway operation. One way of doing it is to educate the younger men through attendance at such meetings as it is these younger men who later will hold the responsible positions in railroad organizations.

Equitable Contract for Interlockers

The ownership, maintenance and operation of joint interlocking plants are in many cases the source of continued contention between the railroads interested. Especially in many of the older plants the senior road owning a majority of the plants may now have a branch line traffic to handle, whereas the junior road with heavier traffic may desire certain improvements in locking circuits to expedite traffic that, according to the original arbitrary basis of ownership and maintenance, would require expenses to the senior road entirely out of proportion to the benefits derived. Figuring these charges on the basis of levers in the machine, required by each road, has resulted in unreasonable connections and the overloading of levers, thus causing difficult operating conditions for the leverman. The equitable basis for the installation, maintenance and operation costs of such properties is on the unit basis, in which each switch, derail, signal lock or track circuit has a fixed value regardless of the levers required. The majority of the Committee on Contracts was interested in the signal valuation work ordered by the Interstate Commerce Commission in which many difficulties were encountered on interpreting contracts for interlocking plants. These men have worked hard to establish a unit basis for contracts and the railroads will do well to give this matter due consideration on all new work.

The Art of Making Concrete

For several years the Committee on Masonry has included as an interesting feature of its report, a review of current developments in the art of making concrete. In general, this has had to do with rules of good practice in the selection and grading of materials, and the proportioning, mixing, delivery, depositing and curing of concrete, as these controlling elements in the various phases of concrete construction have been analyzed through a careful study of laboratory tests. The report presented by the committee this year approaches the subject from a somewhat different angle. Rather than present further suggestions for improved practice, the committee endeavored to record progress in the practical application of the improved methods to actual construction. The railway

officer who reads this record of practical demonstrations cited will be impressed by the fact that, while this report has been prepared by a committee of a railway association, not one of the examples offered relates to railroad work. The committee, however, cautions against an unwarranted inference that the railroads have made little progress along the lines in question and announces the intention of reviewing railroad development in these improved practices during the course of the coming year. We wish the committee success, but there is reason to believe that evidences of advance practice in concrete construction by the railroads will not be encountered as frequently as in highway construction, building work, or large hydro-electric projects. In work of these three classes, the volume of concrete looms large in the total cost of the undertaking and, therefore, receives the direct supervision of the engineer in charge. On the railroads much of the concrete work is in small volume and comprises but a secondary part in many of the improvement projects. It, therefore, competes with many other details of engineering for the attention of the supervising officer. But these are excuses rather than reasons. The railroads cannot afford to take a secondary part in the application of improved engineering practices. It is up to the members of the association to co-operate with the Committee on Masonry, not only in reporting instances of improved methods of concreting, but in promoting the actual application of these methods to a greater volume of work.

The Engineer and a Centennial of Railroads

FIVE MONTHS AGO, the *Railway Age*, in its editorial pages, suggested the advisability of the railroads celebrating the occasion of their hundredth anniversary. Monday the subject came before the Board of Direction of the American Railway Engineering Association and it is anticipated that this subject will be brought before the convention in order that the engineers may be informed about it and express themselves regarding it. Engineers are interested in a proposal of this kind, as every other railway organization is interested, because it has a direct bearing upon the future well being of railroads of which they are a part. Celebrating the hundredth anniversary of railroads would afford a splendid means of making the public see them in a better light. The public does not have a correct understanding of the railway situation at the present time, but it does have a great deal to say about what happens to the railroads. It is therefore the concern of every railroad and every department of a railroad to see that the public is given a proper understanding. A centennial celebration would go far in accomplishing this. If we can bring to the attention of the public at a psychological time such as this, whence the railroads have come, the problems they have solved and the conditions that have allowed their development thus far, we can help secure an understanding of their present problems, the tendencies now at work and what must be done in future.

Considering the possibilities that lie in the celebration of such an occasion as the hundredth anniversary of beginning of American railroads, there is no question but that the railways will hold a celebration, if it is at all possible to do so. This being so, it is very important that no time be lost in making preparations for the event and the engineers may well take the first decisive step in this direction.

President Aishton of the American Railway Association referred to the desirability of a centennial celebration in his address before the convention of the Engineering Association yesterday. There is some question as to just when such a celebration might most appropriately be held. It might be held at the time either of the centennial of the invention of the locomotive, or of the beginning of the actual construction of the first railway in America. In either case the celebration would be held within the next five years. Railroad transportation has played such a tremendously important part in the development of the United States that this country, above all others, should celebrate its centenary.

Who Benefits by Efficiency and Economy?

PRESIDENT AISHTON of the American Railway Association, touched briefly in his address at the Engineering Association convention yesterday upon one of the most vital facts about the railroad situation. He emphasized the importance and necessity of work such as that of the members of the Engineering Association to increase efficiency and economy in operation. In addition he adverted to the desirability of the public being informed regarding the things done to increase the efficiency and economy of operation.

How many people stop to reflect that a general increase in the efficiency and economy of railway operation *alone* does the owners of railway securities no good? It may be said that efficient and economical operation reduces operating expenses and this results in an increase in the net return earned which goes to the bondholders and the stockholders in the form of interest and dividends. Broadly speaking, however, this is exactly what does not happen. The railways at present are handling a great deal more business than six years ago. Allowing for differences in unit costs of fuel, labor and materials, they are handling it more efficiently and economically. They are not, however, earning as much net return as they were six years ago. Why is this? It is because, under the policy of regulation to which they are subjected, every saving made in operating expenses tends to be taken away from the railways through reduction of rates. Now, an increase in efficiency and economy which makes it possible to reduce rates is in that respect of direct benefit to the public, but it is of no benefit whatever to owners of railway securities unless it results also in an increase of net return.

From the standpoint of the owners of railway securities, therefore, no mere increase in the efficiency and economy of operation can be regarded as proof of really good management. Good management from the standpoint of the investor will result not only in good service, economically rendered, but also in adequate net return. This calls attention to the greatest shortcoming of railway management in this country. The entire official organization of every railroad, from the president down to the supervisory officers, is constantly engaged in trying to increase the efficiency and economy of operation. Every railway official regards this as a part of his business. On the other hand, only a relatively few officers and employees regard it as any part of their business to help create a public sentiment and secure a policy of regulation which will enable the railways themselves and their security owners to benefit through increased net return by the economies effected.

In the long run adverse public sentiment resulting in regulation that unduly restricts net return restricts rail-

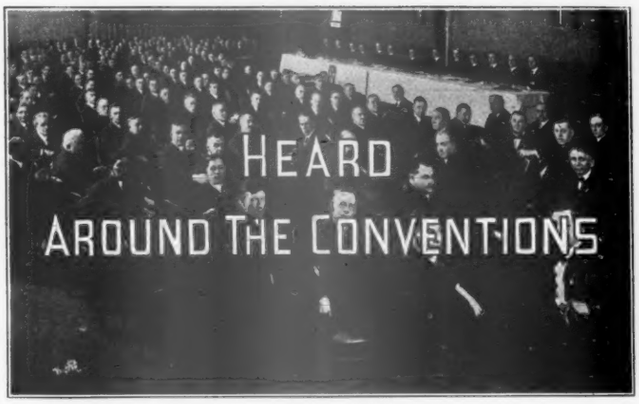
road development, with the result that the public itself as well as the security owners are deprived of the principal benefits that should be derived from efficiency and economy in operation.

The Approach of Normal Railroad Conditions

THE RAILWAY conventions which began yesterday are the first conventions of the engineering and signaling organizations which have been held under conditions even remotely approaching normal for at least six years. When the conventions were held in 1918, the country was at war, and the railways were under government control. In 1919 the railways were still under government control. In the spring of 1920 they had just been returned to private operation, and while the Transportation Act had gone into effect, there was great uncertainty regarding the immediate future. In 1921 the country was in the midst of a profound industrial depression which was preventing most railway development work. In the spring of 1922 the country had not yet emerged from the industrial depression and plans for doing additions and betterments work and buying equipment were still in abeyance. This year the conventions meet when the railways are handling the largest freight business in history; when they are earning a substantially increased net return, and when they are making or actually carrying out the largest programs for additions and betterments work and purchase of equipment in ten years. It seems almost like the "good old times."

Prospects are that the present relatively favorable conditions will continue to prevail throughout the present year. There is a great deal of anti-railroad sentiment in the western states and a serious threat of adverse legislation when the next Congress meets. It will, however, be almost nine months before Congress meets, and there is some ground for hoping that by that time there will be an improvement in public sentiment, and that the harmful legislation which now seems to threaten will be avoided. Meantime, railway officers can congratulate themselves that their business is again one in which, for the present, at least, constructive work can be done and progress can be made in making improvements that will increase the efficiency and economy of operation, and enlarge the amount of business that can be handled. The railroads have had a hard pull during the past three years that have elapsed since they were returned to private operation. They were returned under legislation which it was supposed would result in their being allowed to earn an average net return of approximately six per cent on their valuation. The net return actually received by them during the entire period has averaged less than four per cent. A large part of the time many railways have been on the verge of bankruptcy. At the present time the net operating income being earned is the most satisfactory it has been since the railways were returned to private operation.

There is good reason for believing that within the last three years the railways have passed through the worst troubles that they are going to have for some time, although, of course, their future will depend largely on public sentiment and government regulation. The establishment of a friendly public sentiment appreciative of the efforts of the roads to provide efficient transportation service should be the goal of every railroad official today.



The Committee on Buildings of the Engineering Association will hold a meeting in Room 1166 at two o'clock this afternoon. Full attendance of the members of this committee is desired.

* * *

The Committee on Uniform General Contract Forms of the Engineering Association will hold a short but important meeting on Wednesday, the place and hour to be announced in the convention this morning.

* * *

S. R. Church, chairman of the sub-committee on preservatives of Committee D-7 of the American Society for Testing Materials, has called a meeting of this committee at room 1322, Congress hotel, at 10 o'clock this morning.

* * *

C. W. Kelly of the Kelly-Derby Company, Chicago, was re-elected secretary-treasurer and director of exhibits of the National Railway Appliances Association at the directors' meeting. The office of the association is to be continued in the Peoples Gas Bldg., Chicago.

* * *

Members of the Signal section have received an invitation from the Art Institute to visit it at a time convenient to the members. The nominal admission charge will be waived on the presentation of the official badge or on identification by railroad pass.

* * *

Arrangements have been made for table No. 17 at the annual dinner of the Engineering Association in the Gold Room tonight to be reserved for alumni of Cornell University, who may secure tickets at this table on application to Mr. Wallace at the registration desk.

* * *

The Signal section will have an official photograph taken at 12 o'clock noon today just outside of the building in order to secure a record for its archives. This will be the first official photograph taken since the section became a part of the American Railway Association.

* * *

The Chicago & Eastern Illinois has instructed the Miller Train Control Corporation to proceed with the installation of its device on all of the new engines which are being received for the Chicago division. Six Pacific type locomotives and ten Mikado freight locomotives are to be equipped.

* * *

The Executive Committee of the American Railway Bridge & Building Association held a meeting in the Elizabethan room of the Congress hotel at five o'clock last evening with an attendance of 12. This meeting was called by Arthur Ridgway, president of the association, for the purpose of reviewing the progress being made in the work of the various standing committees. The

business of the meeting included a thorough discussion of plans for the convention to be held in Seattle next October.

* * *

All of the division water service supervisors on the Illinois Central-Yazoo & Mississippi Valley system except two and all of the line inspectors and foremen, a total of 22, are in attendance at the convention. They gave a dinner last evening in honor of A. Gustavson who was division supervisor of water service of the Iowa division until his retirement on March 1 after 35 years' continuous service.

* * *

The American Railway Signal Supervisory Association held its annual meeting and dinner at the Illinois Athletic Club on Monday evening. In addition to the usual business the following officers were elected for the coming year: F. F. Seeburger (C. M. & St. P.), president; E. C. Grant (U. P.), vice-president; H. L. Kilian (N. Y. C.) and I. F. Gillan (C. M. & St. P.), trustees. Caleb Drake (C. & N. W.), was re-elected as secretary and treasurer.

* * *

It is not often that the American Railway Engineering Association becomes involved in matters of parliamentary practice, although in yesterday's discussion of the report of the Committee on Rail parliamentary procedure loomed large in the procedure. After marching up the hill by way of a defeat of the committee's motion to adopt one feature of its report, the convention saw the error of its ways and eventually marched down the hill again, but it took the efforts of two past presidents to show the members that they were wasting time on matters of minor consequence.

* * *

George Hull Porter of the Western Electric Company has extended an invitation to the Signal section to visit the Hawthorne works of that company on Thursday afternoon. Arrangements have been made for those taking the trip to leave the Aurora-Elgin Electric line station on Wells street at 12:30 p. m. A special car will be provided by the Western Electric Company for this purpose and arrangements can be made to return at any time convenient for those who may have to leave early Luncheon will be served at the Hawthorne plant after which an inspection of the plant will be made.

* * *

The Signal Appliance Association held its annual meeting on Tuesday morning and elected the following officers for next year: Chairman, E. A. Condit, Jr., Rail Joint Company, New York; vice-chairman, J. H. Hackett, The Okonite Company, New York; secretary-treasurer, F. W. Edmunds, Craft Incorporated, New York. The new members of the Executive commitee are J. J. Hubbard, Federal Signal Company, New York; W. J. Gillingham, Hall Switch Signal Company, Garwood, N. J.; G. A. Nelson, Waterbury Battery Company, New York; John Roberts, General Electric Company, Schenectady, N. Y.; Paul E Carter, General Railway Signal Company, New York; G. A. Blackmore, Union Switch & Signal Company, Swissvale, Pa.

* * *

The importance of the American Railway Engineering Association as a factor in standardization as it is now being fostered by the American Engineering Standards Committee is evidenced by the attendance at the convention of Albert W. Whitney and John A. Capp, chairman and vice-chairman respectively, representatives of the Engineering Standards Committee, both of whom addressed the convention yesterday in connection with the report of the Special Committee on Standardization. The status of standardization with particular respect to the more general adoption of the standards of the American Railway Engineering Association was also discussed in no uncertain terms by Mr. Aishton in his brief talk before the convention yesterday morning. Mr. Aishton pointed very definitely to one avenue through which the members could direct their individual efforts to secure the more general adoption of the association's standards without outside assistance.

Today's A. R. E. A. Convention Program

Following is the program for the convention of the American Railway Engineering Association which will be called to order at nine o'clock this morning in the Florentine Room of the Congress hotel:

Ties ..... Bulletin 252
Economics of Railway Location ..... Bulletin 252
Economics of Railway Labor ..... Bulletin 252
Stresses in Railroad Track ..... Bulletin 253
Memorial Meeting (Eleven o'clock.)
Track ..... Bulletin 253
Economics of Railway Operation ..... Bulletin 255
Rules and Organization ..... Bulletin 253
Roadway ..... Bulletin 253
Annual Dinner at 6:30 p. m. (Gold Room, Congress Hotel).

Signal Section Program

The program for this morning's session of the Signal section of the American Railway Association at the Drake hotel is as follows:

Committee XIII. Electrical Testing.
Committee XIX. Economics of Railway Signaling.
Committee VI. Standard Design.
American Engineering Standards Committee.

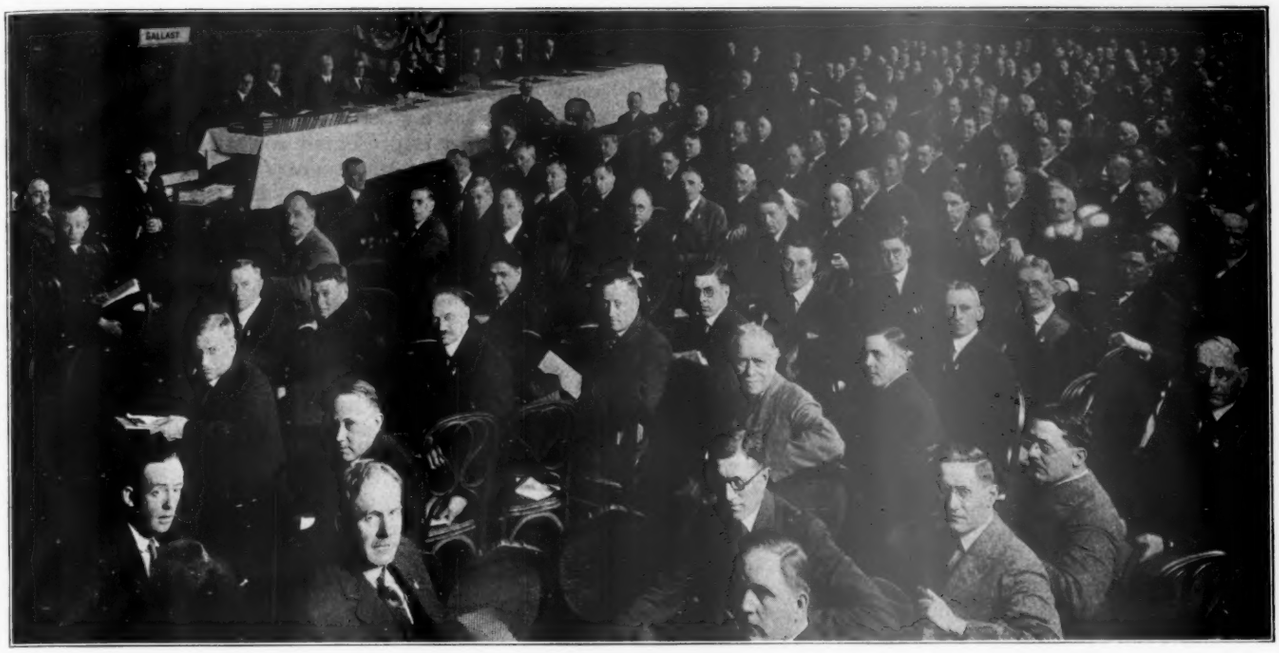
There will be no afternoon session.

The A. R. E. A. Annual Dinner

Arrangements have been completed for the annual dinner of the A.R.E.A. which will be given in the Gold Room of the Congress hotel at 6:30 this evening. Tickets may be secured from W. A. Wallace of the Arrangements committee in the lobby back of the registration booth. The speakers will include Hon. F. B. Carvell, chief commissioner, Board of Railway Commissioners for Canada, who will discuss "The Canadian Railway Problem"; Floyd W. Parsons, editor and journalist, who will speak on "Looking Ahead," and Judge Harry V. Osborne, president, New Jersey Board of Public Utility Commissioners.

A. A. Taylor Leaves Fairbanks-Morse

A. A. Taylor has resigned as manager of the railroad division of Fairbanks, Morse & Co., Chicago, to become vice president and general manager of the Locomotive Firebox Company, with headquarters at Chicago. Mr. Taylor entered railway service in 1887 and became connected with Fairbanks, Morse & Co., on February 1, 1899, as a salesman in the railroad department in the southeastern territory. He was promoted to manager of that part of the railroad department handled from Chicago in 1906, and was placed in charge of the railroad division with jurisdiction over all railroad sales in the United States and foreign countries in September, 1915. Mr. Taylor has been active in the work of the National Railway Appliances Association, of which he has served as a director for the last three years. Mr. Taylor was the guest at a dinner given by his associates in the Fairbanks, Morse organization at the Union League Club on Monday evening.



A. R. E. A. in Session Yesterday at the Congress Hotel

Proceedings of the Engineering Association

Capacity of Florentine Room Taxed by Large Crowd at Opening Session Yesterday Morning

THE ATTENDANCE at the opening session of the American Railway Engineering Association when the meeting was called to order by President Campbell yesterday morning was the largest in the history of this organization. Every seat in the room was taken throughout the morning. After calling the meeting to order J. L. Campbell, president, addressed the association, reviewing the activities of the year and referring to the problems confronting the association, after which the reports of the secretary and treasurer were presented. R. H. Aishton, president of the American Railway Association, also addressed the meeting. The association then began the consideration of the reports of the various standing and special committees.

Reports were presented by the committees on Shops and Locomotive Terminals; Signals and Interlocking; Standardization; Rail; Ballast; Signs, Fences and Crossings; Masonry; Iron and Steel Structures and Water Service.

Address of President Campbell

SINCE WE MET a year ago, death has claimed the following members: A. S. Baldwin, C. E. Lindsay, Wm. McNab, A. L. Johnson, S. B. Rice, W. A. Bostwick, A. W. Gibbs, A. F. Rust, W. F. Purdy, F. J. Angier, A. T. Hardin, C. H. Niemeyer and John Ehrke.

Financially and numerically, the association is in a sound condition. During the year, receipts were $42,580.25 and expenditures $39,287.09, the excess of receipts over expenditures being $3,283.16. The net membership increased from 1,960 to 2,003.

The revision of the Manual of Recommended Practice to 1922 was completed and the new edition issued. The portfolio of track plans, published separately, is a part of the Manual which is now a volume of 1,000 pages.

Outstanding in the activities, the committee work remains pre-eminent. Shortly after the development of the labor troubles last summer, your president inquired of each committee chairman about the effect of the strike upon committee work. All replied saying that while the burdens and responsibilities thrown upon the committeemen by the situation were handicapping the association work, the committee reports would be maintained to the usual high standard. In your examination of the reports, now before you, you have the confirmation of the forecast of the chairman; the demonstration of the loyalty, resourcefulness and effectiveness of the members who do the work; and the proof of the capacity of the American Railway Engineering Association to function successfully under adverse conditions.

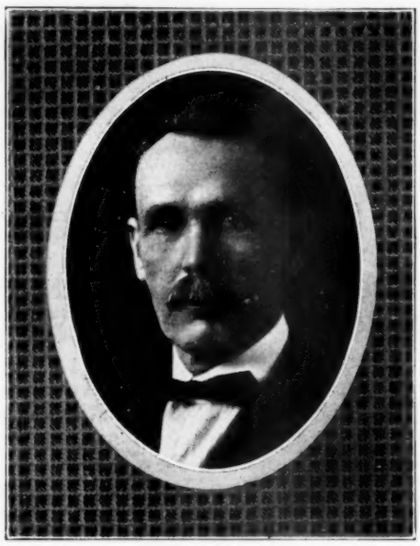
Time and space forbid specific reference to each report. Attention may be directed to the progress report of the Committee on Stresses in Track which lays foundation for full discovery and application of the principles which should apply in track construction; to the tentative experimental rail specifications of the Rail committee, accepted by the manufacturers and approved by the American Railway Association for experimental purposes to enable railways to test under service conditions experimental lots of rail designed in chemical composition and action to eliminate segregation and resulting forms of rail failure; and to the report of the Committee on Wood Preservation reviewing to date its collaboration with the National Research Council in the study of marine borers and their ravages along the Atlantic,

Gulf and Pacific coasts—a subject of pressing importance to railways having terminals at tidewater.

During the year, there has been, through appropriate committees or representatives, collaboration with other organizations as follows:

(a) With the American Committee on Electrolysis.
(b) With the Associated General Contractors of America on a universal contract from.
(c) With the universities on the creation of a joint committee on coöperative relations between the association and the universities.
(d) With the Interstate Commerce Commission on the revision of the classification of accounts of steam railways.
(e) With the American Engineering Standards Committee on standardization.

The American Railway Engineering Association does the work of the Construction Maintenance section of the Engineering division of the American Railway Association. Collaboration with the Central Committee on Lumber Standards of the National Lumber Manufacturers' Association on standardization of lumber grade and with the United States Air Service on marking air routes has been initiated. The International Railway Congress applied to the American Railway Association for a topic for consideration at the railway congress to be held in London in 1925. Upon request, the Engineering Division recommended to the Railway Association for transmittal to the Railway Congress the subject of, "Grade and Alignment Revision vs. Heavy Steam Power or Electrification," as a problem of general importance.



J. L. Campbell
President

The Interstate Commerce Commission is revising the classification of accounts of steam railways. This revision is important. The engineering department is now specifically interested in having a classification and system of accounting that directly yields in workable segregation all the facts required by Valuation Order No. 3 in keeping up to date the valuation of railway property required by law. The Commission responded cordially to the suggestion that the association be permitted to collaborate in the revision through its committee on Records and Accounts. This contact has been established between the committee of the association and the Bureau of Accounts of the commission.

There is still need and room for improvement in the quality and service of the track rail, notwithstanding the notable degree of perfection and dependability to which it has been brought. Segregation of metal is still a problem and it does not appear that the best method of testing rails has been found. Solution of such problems undoubtedly requires a vast amount of research and laboratory work requiring collaboration between the committee on Rail and the Special Committee on Stresses in Track. For the purposes indicated, these two committees could well be related in a joint committee on rail and stresses in track adequately financed to cover the cost of the work.

The industrial countries are gravitating to standardization of things in common use. In no less than 15 of them, there is a national standardization body composed by association of representative engineering, industrial and governmental organizations for the work of standardization. In the United States this body is known as the American Engineering Standards Committee. International contact between the bodies of the various countries is established. The standardization body does not initiate or formulate standards. It is a clearing house wherein the constituent members thereof agree as to what shall be a standard for a particular thing. A proposed standard is presented for approval by one of the members known as the sponsor therefor. Any proposed modification of the proposed standard as presented must have the approval of the sponsor before it can be approved and promulgated as a standard by the standardization body.

There is a division of opinion in the American Railway Engineering Association and in the American Railway Association as to whether they should continue (or as to the degree of) affiliation with and participation in the work of the American Engineering Standards Committee. Specifically, the adverse opinion rests primarily on the reasoning that since the requirements of the railways are so large, distinctive and important, they should make their own standards untrammelled by entangling alliances. As to things exclusively used by the railways, this argument has great force. As to things used in common by them and others, it loses weight. This is a rather pressing question that should be settled at an early date.

Considered per se., there is a consensus of conviction that standardization is desirable; that it eliminates confusion and a material part of the time and cost of production and distribution; and that it results in reliability, efficiency and profit in industrial and commercial activities. The general objection to standardization is that it tends to stagnation of progress and improvement as to the thing standardized. Standardization must not become fossilization. If standardization was synonymous with perfection in the thing standardized, the objection would disappear; but with it would go also standardization for perfection is rarely, perhaps never attained. So, while there should be standardization of things highly developed and thoroughly proved, it should be with the understanding that the standard is subject to revision from time to time as progress in the art or thing warrants or requires.

For more than a score of years, the American Railway Engineering Association has been engaged upon the work of standardization for the roadway and track of the railways and it has recorded the results of its labors and conclusions in its Manual under the name of Recommended Practice. Recommended Practice is a tentative stage of standardization. It is, nevertheless, a standard. The Association may well consider whether it should begin advancement of its recommended practice to the weight, dignity and positiveness of avowed standards.

Your president addressed a letter to the chief executive of each railway having 200 or more miles of road, calling attention to the track plans and specifications for frogs, switches and crossings which had been in preparation and revision from year to year by the track committee and finally approved by the last annual convention for publication in the Manual as recommended practice and requesting that the suggestion that they be adopted as standard for the road receive due considera-

tion. Replies representing 117,495 miles of road were received. Of this mileage, 27,563, or 23.5 per cent have made the recommended practice standard or as nearly so as practicable and 42,465, or 36 per cent of the mileage represented, have taken the recommended practice as a guide.

Every member of this association should sell these standards to his road.

Until the Committee on Economics of Railway Labor was created, the work of the American Railway Engineering Association was directed only to the solution of the physical problems of railway construction, maintenance and operation of the physical property of the railways. The economics of labor covers more than that and includes the welfare of labor.

Railway engineers are masters in solving the physical problems of transportation. They have done very well indeed in that. But the most difficult problem of the transportation or any other business is not physical. The really formidable problem is the human equation. If mind and heart were amenable to the principles and rules of physical science as they are applied in solution of physical problems, the engineering department would be the department in which the problem of the human factor could be solved. But it is not so. The human equation, overshadowing every other in all the relations of life, requires for its solution (and it must be solved) a department of religion. Its solution will be found in the teachings of Jesus Christ equally assimilated and jointly practiced by employer and employe. There is no hope in the rule of might uncontrolled by right. "The fear of God is the beginning of wisdom" and the secure foundation for industrial association and activity.

While no department of a railway is fashioned primarily for the purpose of solving the human problem, railway engineers are, by training and necessary familiarity with and loyalty to that part of truth found in the principles and facts of nature involved in the science and art of controlling and directing the physical forces of nature to the use and convenience of man, qualified to become proficient in the higher science and art of directing the spiritual forces in nature to the end that there shall be more fully established among men and between employer and employe right relations and purposes. In this higher kingdom wherein lies the destinies of men and nations and the keys to the solution of life and society, the members of the American Railway Engineering Association have, individually, opportunity for service of fundamental value to the transportation business and to society.

Report of the Secretary

Membership March 1, 1922		1,960
Additions	96	
Deceased members	13	
Resignations	33	
	46	
Gain	50	50
Membership March 1, 1923		2,010

Co-operation with Other Organizations

Your Association has continued collaboration with various organizations on matters of mutual interest. Contact has also been established to carry on studies of a number of new and timely subjects. The following table contains a summary of such co-operative activities:

Classification of Accounts	Interstate Commerce Commission.
Concrete and Reinforced Concrete	Joint Committee on Concrete and Reinforced Concrete.
Concrete Pipe Specifications	American Concrete Pipe Association; Iowa State College; Bureau of Public Roads.
Construction Contract Form	Associated General Contractors of America.
Cross-tie Statistics; Timber Preservation	Forest Products Laboratory, U. S. Department of Agriculture.
Drinking Water Supplies	Public Health Bureau, U. S. Treasury Department.
Electrolysis	American Committee on Electrolysis.
Grading of Lumber and Timber	Central Committee on Lumber Standards.
Layout and Design of Engine Houses, Car Shops, Power Plants, etc.	Mechanical Division, American Railway Association.
Marking of Airways for the Guidance of Fliers in Air Service	Chief of Air Service, U. S. Government.
Marine Piling Investigations	National Research Council.
National Electrical Safety Code	Bureau of Standards.
Rail Manufacture	Manufacturers' Rail Committee.
Scale Specifications	Bureau of Standards; Scale Manufacturers' Association.
Standardization—various projects	American Engineering Standards Committee.
Stresses in Railroad Track	American Railway Association; University of Illinois; American Society of Civil Engineers.
Storehouses	Purchases and Store Division, American Railway Association.
Taper of Tread of Car Wheels	Mechanical Division, American Railway Association.
Tests on I-Beams and Pins	Lafayette College.
Water Power	U. S. Geological Survey.
Wire Crossings Over Railways	Telegraph and Telephone Section, A. R. A.; Am. Electric Railway Association; Western Union Telegraph Company; American Telegraph and Telephone Company.

Deceased Members

Losses by death from the membership during the past year have been as follows:

F. J. Angier, superintendent timber preservation, Baltimore & Ohio.

A. S. Baldwin (past-president), vice-president, Illinois Central.

W. A. Bostwick, assistant to president, International Nickel Company.

John Ehrke, assistant to general superintendent, Grand Trunk.

A. W. Gibbs, chief mechanical engineer, Pennsylvania System.

A. T. Hardin, vice-president operation, New York Central Lines.

A. L. Johnson, Corrugated Bar Company.

Charles E. Lindsay (director), special engineer, New York Central.

William McNab (past-president), chairman valuation committee, Grand Trunk.

C. H. Niemeyer, assistant engineer maintenance, Pennsylvania System.

W. F. Purdy, resident engineer, Monongahela Southern.

S. B. Rice, engineer maintenance of way, Richmond, Fredericksburg & Potomac.

A. F. Rust, consulting engineer, Kansas City Southern.

Amendment to Constitution

The vote on the proposed amendment to the Constitution, involving a change of time for the annual meetings of the Association, resulted as follows:

For the amendment.....696 votes
Against the amendment..... 57 votes

A majority of the votes being in the affirmative, the change will take effect March 15, 1923.

Respectfully submitted,
E. H. Fritch, Secretary.

Financial Statement for Calendar Year Ending December 31, 1922

Balance on hand January 1, 1922.....$44,742.51

RECEIPTS

Membership Account	
Entrance Fees	$ 1,090.00
Dues	9,266.09
Subscription to Bulletins	9,266.09
Binding Proceedings and Manual	1,453.50
Badges	17.50
Sale of Publications	
Proceedings	3,272.85
Bulletins	1,208.00
Manual	33.78
Specifications	420.55
Leaflets	68.10
General Index	15.00
Advertising	
Publications	1,173.50
Interest Account	
Investments	2,221.18
Bank Balance	125.62
Annual Meeting	
Sale of Dinner Tickets	1,049.00
Miscellaneous	96.45
American Railway Association	
Rail Committee	11,803.04
Total	$42,580.25

DISBURSEMENTS

Salaries	$ 6,900.00
Proceedings	6,679.81
Bulletins	8,567.27
Manual	83.18
Stationery and Printing	791.50
Rents, Light, etc.	845.00
Telegrams and Telephone	15.58
Equipment	23.85
Supplies	104.90
Expressage	488.34
Postage	817.56
Exchange	49.44
Committee Expenses	158.91
Officers' Expenses	17.98
Annual Meeting	2,475.99
Refund	20.50
Audit	150.00
Rail Committee	10.591.06
Miscellaneous	516.22
Total	$39,297.09

Excess of Receipts over Disbursements	3,283.16
Balance on hand, December 31, 1922	$48,025.67
Consisting of:	
Bonds	$40,794.14
Cash in Bank	7,206.53
Petty Cash Fund	25.00
	$48,025.67

STRESSES IN TRACK FUND

Balance on hand January 1, 1922	$ 962.20
Received from interest during 1922	26.47
Total	$ 988.67
Disbursements:	
Supplies	$ 47.97
Balance on hand in S. T. & S. Bank December 31, 1922	$ 940.70

REPORT OF THE TREASURER

Balance on hand January 1, 1922	$44,742.51
Receipts during 1922	$42,580.25
Paid out on audited vouchers, 1922	39,297.09
Excess of Receipts over Disbursements	$ 3,283.16
Balance on hand December 31, 1922	$48,025.67
Consisting of:	
Bonds	$40,794.14
Cash in Bank	7,206.53
Petty Cash	25.00
	$48,025.67

STRESSES IN TRACK FUND

Balance on hand January 1, 1922	$ 962.20
Received from interest during 1922	26.47
Total	$ 988.67
Paid out on audited vouchers during 1922	47.97
Balance on hand December 31, 1922	$ 940.70

The securities listed above are in a safety deposit box of the Merchants' Loan & Trust Safe Deposit Company, Chicago.

Respectfully submitted,
GEO. H. BREMNER,
Treasurer.

GENERAL BALANCE SHEET
December 31, 1922

Assets	1922	1921
Due from Members	$ 3,358.50	$ 4,710.84
Due from Sale of Publications	1,078.94	1,286.82
Due from Advertising	1,865.00	680.00
Due from American Railway Association	1,275.25	2,459.68
Furniture and Fixtures (cost)	997.40	997.40
Gold Badges	68.00	84.00
Publications on hand (estimated)	6,000.00	6,000.00
Manual	9,575.75	.....
Extensometers	500.00	500.00
Investments (cost)	40,794.14	40,565.65
Interest on investments (accrued)	580.05	750.05
Cash in Standard Trust and Savings Bank	7,206.53	4,151.86
Petty Cash Fund	25.00	25.00
Total	$73,324.56	$62,211.30
Liabilities		
Members' Dues paid in advance	$ 4,832.50	$ 5,211.50
Impact Test Fund on Electrified Railways	285.46	285.46
Advertising paid in advance	70.00	85.00
Due for Printing (Bulletins)	1,314.69	102.58
Due for Printing (Manual)	9,575.75	.....
Surplus	57,246.16	56,526.76
Total	$73,324.56	$62,211.30

President Aishton Addresses A. R. E. A.

President Campbell suspended the discussion of committee reports at the session of the American Railway Engineering Association yesterday morning for the purpose of introducing R. H. Aishton, president of the American Railway Association, who addressed the meeting for a few moments. Mr. Aishton opened his remarks by reference to the discussion on standardization and continued as follows:

"I have listened to the discussion on standards, and my interest in the discussion has been accentuated by the fact that I brought this matter to your attention. I am not going to discuss the question, but I am a believer in standardization to a certain point. I believe that progress is going to be made along those lines. As far as the American Railway Association is concerned, whatever your position on this subject may be, if you decide to participate in the work of the American Engineering Standards Committee, you shall have my co-operation.

"This is the twenty-fourth annual convention of your association. In 1925 the railroads have an opportunity to participate in the centennial celebration of the opening of the first railroad in the world. Arrangements are being made for a fitting celebration by the International Railway Congress, in the home of the first railroad—England. There is another centennial to be observed a year or two later than that, and that is the beginning of the first railroad in the United States, on July 4, 1928. I believe on July 4, 1828, the first spike was driven in the first railroad to be operated in the United States.

"I believe it is fitting that this association should make a recommendation of some kind to the railroads as to what, if any, action should be taken on a matter of that kind, and whether there should be a centennial celebration in 1925 of the first railroad in the world, or a centennial celebration in 1928 of the first railroad in this country. I have a decided sentiment that a fitting celebration of that kind will have a good effect on the public in indicating what has been accomplished by the railroads in that

period. After discussion of this subject I think it would be well for this association to go on record with regard to this celebration, and in announcing its decision to refer to the great progress which has been accomplished.

"In addition to this being the twenty-fourth annual convention of your association, it is also the annual meeting of the Engineering Division of the A. R. A. I have not been able to determine whether the two associations are one, or twins or triplets, or what not, but we seem to have brought about, by the affiliation, or whatever you may call it, a close co-operation between all the essential parts of railroads as represented in the American Railway Association. I notice in your program for this meeting that you refer to the question of drinking water supplies on trains and railway premises, and I presume that your committees have also dealt with the medical sections which have those questions in mind. You also refer to the pitting and corrosion of boiler tubes and sheets. I notice that you study the economics of railway labor, including plans and methods pertaining to railway labor. That is a big situation, and it is of the utmost importance to the railroads that the best and latest thought be developed on that—not only to obtain the labor for the railroads, but to retain that labor. That is one of the most important problems presented to the railroads. I note also the report of your committee on Stresses in Track, which shows a tremendous amount of work.

"There is the Manual—that represents 24 years of hard work of the best trained engineering ability in the United States, and probably the world. Specifications go out in this Manual, which represents years of hard work of the best talent in this country on the subjects dealt with, and it should be accepted and followed strictly when it goes out. What happens? You gentlemen pass a lot of resolutions—and there is not an association I know of where there is any more concise and intensive discussion than in this association—and when you get all through you agree on the standard specifications, yet there is evidently little knowledge on the part of a good many railroads of what that means. What I am getting at is this: When your committees and the membership of the association put in as much hard work as they do on your specifications, you should go home and sell the result of your work to your higher officers—you should tell your neighbors, and tell all of the people with whom you come in contact of the great value of the material in this Manual. Point out to them in exacting detail just why they should adopt such specifications. In that way you will make more progress in standardization. You will find that these reports will greatly aid in the adoption of correct methods on the various railroads.

"Your reports should be in the hands of every maintenance of way and construction officer on every railroad in the United States. In a word, you must do your very best to sell the action on these reports to the various officers who can use them. I do not suppose the association gets back the money it puts into these things, but if the benefits which would come through this standardization were fully realized and were put into operation, it would give the public knowledge of the steps that the railroads are taking to improve the operation of the roads.

"What is the criticism of the railroads today? Lack of economy and efficiency. Why? Because economy is reflected in freight rates and passenger rates. Those are the things with which the public are most largely concerned. Efficiency is reflected in service, and that is what the farmer wants. Make it apparent to the public that the railroads are doing all that is possible in the direction of economy and efficiency.

"I am saying these things to you, as I have to other branches of the American Railway Association, because I believe in it, and because for the last two years one of my principal duties has been to show the bodies which have to do with the control of the railways what the railways themselves are doing to bring about economy and efficiency.

"I hope that the American Railway Association is of help to you. If it is not, it is because you do not tell us what you want. I cannot close without a word of appreciation for the splendid help that President Campbell and Secretary Fritch have given to the American Railway Association in the past year.

Report on Iron and Steel Structures

The most important feature in the report of the Committee on Iron and Steel Structures was a set of complete specifications for steel highway bridges, something which will fill a real need because railway engineering officers are now frequently required to design and construct highway bridges as a consequence of the enormous highway construction programs. The report also included specifications for the erection of steel railway bridges, now presented in final form for approval and inclusion in the Manual. Rules for the classification of old bridges were presented as a further step in the program for the systematic organization of this important work.

O. F. Dalstrom
Chairman

The appointment of O. F. Dalstrom as chairman of the Committee on Iron and Steel Structures is unique in that it occurred after Mr. Dalstrom had had only a short period of service with the committee and the association. Being bridge engineer of the Chicago & North Western, he conforms to the traditions of the committee, whose railroad membership has been always comprised primarily of the heads of the railroad bridge departments. Mr. Dalstrom has gained all of his railway experience with the North Western, having entered the employ of that road as a draftsman in 1906, being advanced in turn to office engineer, chief draftsman and engineer of bridges.

Revision of the Manual

THE FOLLOWING CHANGES in the General Specifications for Steel Railway Bridges, 1920, are recommended.

Article 21.—Change this article by including in it as a separate paragraph all of present Article 22. Article 21 will then read as follows: "In special locations, where the conditions limit the loading to light engines, a lighter loading, as stipulated by the Engineer, may be used, but not in any case lighter than three-fourths of that specified in Article 20.

Other live loadings shall be proportional to the loading specified in Article 20, with the same wheel spacing."

Article 22.—New article of this number to read as follows: *"A train load of 1,200 lb. per lin. ft. of one track shall be used in*

determining the stability of spans and towers against overturning."

Article 30.—Change this article to read as follows: "Impact shall not be added to stresses produced by longitudinal or lateral forces, *or by the train load specified in Article 22."*

Article 32.—Change this article to read as follows: *"The wind force on the structure shall be a moving load* of 30 lb. per sq. ft. on 1½ times *its* vertical projection on a plane parallel with its axis, but *not* less than 200 lb. per lin. ft. at the loaded chord *or flange,* and 150 lb. per lin. ft. at the unloaded chord *or flange.*

"The wind force on the train shall be a moving load of 300 lb. per lin. ft. on one track, applied 8 ft. above the base of rail."

Article 33.—Change this article to read as follows: *"The lateral force to provide for the effect of the sway of the engines and train in addition to the wind loads specified in Article 32, shall be a moving load equal to 5 per cent of the specified live load on one track, but not more than 400 lb. per lin. ft., applied at the base of rail."*

Article 34.—Omit present Article 34, change present Article 35 to read as follows, and make it Article 34: "The lateral bracing between compression chords or flanges *and between the posts of viaduct towers* shall be capable of resisting a transverse shear in any panel equal to 2½ per cent of the total axial stress in the chords *or posts."*

Article 35.—The following new article to be made Article No. 35: *"In proportioning the bracing, Articles 32 and 33 shall be combined, or Article 34 used alone."*

Article 38.—Change by striking out the following item in this article: "Horizontal shear in flange angles of girders.....4,000."

Article 43.—Change to read as follows: *"Web members shall be so proportioned that an increase of live load which will increase the total unit stresses in the chords 50 per cent will not produce total unit stresses in the web members more than 50 per cent greater than the designing stresses."*

Article 48—Change to read: The gross area of the compression flanges of plate girders and rolled beams shall not be less than the gross area of the tension flanges, but the stress per square inch *of gross area shall not exceed*

$$16000 - 150\frac{l}{b}, \text{ in which}$$

l = the length of the unsupported flange between lateral connection of knee braces.

b = the flange width.

Article 49.—Change marginal title to *"Slenderness Ratios,"* and change article to read as follows: *"The ratio of length to least radius of gyration shall not exceed*

100 for main compression members.

120 for wind and sway bracing.

140 for single lacing, and for double lacing not riveted at intersections.

170 for double lacing riveted at intersections."

Article 67—Change the third sentence to read: In main members, the length of the *end* stay plates shall be not less than 1¼ times the distance between the lines of rivets connecting them to the outer flanges, and the length of intermediate stay plates shall be not less than three-quarters of that distance.

Article 69.—Change this article to read as follows: "The lacing of compression members shall be proportioned to resist a shearing stress of 2½ per cent of the direct stress. *The section shall be made as required by Articles 38 and 49, in which l shall be taken as the distance between connections of the lacing to the main sections.*

"The minimum width of lacing bars shall be 3 inches for 1-inch rivets, 2¾ inches for ⅞-inch rivets, 2½ inches for ¾-inch rivets, and 2 inches for ⅝-inch rivets."

Article 74.—Change this article to read as follows: "Abutting joints in compression members faced for bearing shall *have component parts spliced.* The gross area of the splice material shall be not less than 50 per cent of the gross area of the smaller member. *In determining the number of rivets in compression splices, the stress in the splice material shall be taken as 15,000 lb. per sq. in. of gross area."*

Article 109.—Change to read as follows: "Deck truss spans shall have sway bracing at each panel point. *The top lateral loads preferably shall be carried to the supports by means of a complete top lateral system, or the loads may be considered as transferred to the bottom lateral system at each sway frame."*

Article 213—Change to read: Holes in *other* material more than ¾ inch thick shall be drilled.

General Specifications for the Erection of Steel Railway Bridges were presented by the committee in an Appendix A, for printing in the Manual, replacing the part under the heading "Specifications for the Erection of Railway Bridges." These specifications in preliminary form were submitted to the convention in 1922, and published in the *Railway Age* for March 15, 1922, page 634.

The final revision embodies some minor modifications

A report on Classification of Bridges in Appendix B, was submitted as information.

Specifications for Steel Highway Bridges presented in Appendix C, were submitted as information.

Committee: O. F. Dalstrom (C. & N. W.), Chairman; B. R. Leffler (N. Y. C.), Vice-Chairman; F. Auryansen (L. I.), J. A. Bohland (G. N.), A. W. Carpenter (N. Y. C.), M. F. Clements (N. P.), J. E. Crawford (N. W.), R. P. Davis (L. I. of W. Va.), F. O. Dufour (Stone & Webster), Thos. Earle (Beth. Steel Brg. Corp.), W. R. Edwards, Robert Farnham (Penna.), G. A. Haggander (C. B. & Q.), P. G. Lang, Jr. (B. & O.), P. B. Motley (C. P. R.), W. H. Norris (M. C.), Albert Reichmann (Am. Brg. Co.), A. F. Robinson (A. T. & S. F.), H. N. Rodenbaugh (F. E. C.), W. R. Roof (C. G. W.), J. M. Salmon (L. & N.), O. E. Selby (C. C. C. & St. L.), I. L. Simmons (C. R. I. & P.), I. F. Stern (Con. Engr.), H. B. Stuart (C. N. R.), R. M. Stubbs (M. K. & T.), P. B. Spencer (N. Y. N. H. & H.), G. E. Tebbetts (Detroit Graphite), F. E. Turneaure (U. of Wis.), J. A. L. Waddell (Con. Engr.), S. T. Wagner (P. & R.), H. T. Welty (N. Y. C.)

Appendix B—Classification of Railway Bridges

1. The classification of a bridge, as herein determined, is based on the heaviest moving load which may be operated over it in regular service for a limited time without subjecting it to such severe stresses, vibration, or wear of parts as seriously to impair its safety or serviceability.

2. Iron and steel bridges shall be classified according to their rated carrying capacity as determined by the "Rules and Unit Stresses for Rating Existing Bridges" adopted by the American Railway Engineering Association in 1921, page 787 of the Manual, 1921.

Division of Subject.—(3) The work of classifying bridges consists of three steps:

(A) The determination of the capacity and rating of the bridges.

(B) The determination in corresponding terms of the effect and rating of each type and size of engine or other equipment used, in order that the territorial operating limits of each class of equipment may be assigned.

(C) The presentation of such data in form convenient for the operating personnel.

(A) Rating of Bridges

Plans and Records.—(a) Complete plans and records of each bridge shall be kept on file. Where no plans exist, field measurements shall be made and record plans prepared.

Bridge Sketches.—(b) For ready reference, a sketch, or line diagram of each bridge shall be prepared.

Record of Bridge Material.—(c) The records shall show the material of which each bridge is composed. If necessary, the character of the material shall be determined from small specimens obtained in the field.

Assignment of Ratings.—(d) Each bridge shall be calculated on the basis of the rating rules and specification loading in effect. The strength of each member, including connections and other details, shall be determined and the capacity of the bridge ascertained. The bridge shall then be given a rating corresponding to the rating of its weakest member.

Filing of Calculations.—(e) The calculations shall be made in permanent form and filed for future reference.

Bridge Lists.—(f) Lists of all bridges shall be prepared, showing for each bridge the identifying number or name, location, lengths and number of spans, type, number of tracks carried, material of which composed, date built, and capacity.

(B) Rating of Equipment

Line Diagrams of Engines.—(a) A line diagram of each engine shall be obtained and filed for reference. Such diagram shall show the axle loads and wheel spacing of the engine and tender, and the distance between the tender and the following engine when double-headed.

Moments and Shears.—(b) The effect of each engine with its train load shall be ascertained by calculating the bending moments and shears. The calculations shall be based on an arrangement of loads similar to that used in the specifications; that is, if the specification loading provides for double-heading, the calculations shall be made on that basis.

Relation of Loads to Specification Loading.—(c) For each span length for which moments and shears are determined, the effect of the load in terms of the specification loading shall be obtained.

Engine Rating.—(d) The rating of the engine for operating purposes shall be expressed in terms of the engine for which the bridges are rated, and for that span length on which it produces its maximum effect.

List of Engine Ratings.—(e) The rating of an engine may be lower on a particular bridge than its rating for operating purposes if its rating for the span length of that bridge is lower than for the length on which it produces its maximum effect. For that reason a list of engines should be prepared, giving for each engine its number, class, type, total weight, rating for operating purposes, and rating for each span length.

(C) Form of Presentation

Common Standard for Rating.—(a) Following the procedure outlined will result in assigning to each bridge and to each engine a rating based on a common standard.

Cooper Series as the Common Standard.—(b) The long use of the Cooper series as a standard of railroad bridge loading has already imparted to the operating personnel the significance of an operating condition involving engine loadings expressed in such terms. For this reason the Cooper series is adopted as the common standard.

Form for Use of Operating Department.—(c) The ratings of the various lines shall be shown by means of a diagrammatic map, or arranged geographically in a table, or both; the rating of each engine shall be listed.

Special Cases.—(d) Special conditions involving particular bridges on a line or the operation of special engines in certain territories, may be covered by the use of the asterisk or other symbols calling attention to exceptions to a general rule.

Rating of Foreign Engines.—(e) Frequently questions are raised in regard to the movement of foreign engines over a line. The approximate ratings of such engines can readily be determined, if similar engines have previously been rated.

Appendix C—General Specifications for Steel Highway Bridges

(*For Fixed Spans Less Than 300 Feet in Length*—1923)

The purpose of the committee in writing these specifications was to formulate specific and detailed rules for the design and manufacture of steel highway bridges, as a guide to both the designer and the shop, rather than to confine the specifications to a statement of principles or to limit them to rules defining the duties of the contractor. The intention was to describe the best practice and to advance the causes of good design and workmanship.

There have been kept in mind particularly the requirements of highway bridges which must be built by railways, but the specifications are intended to be comprehensive enough to apply to highway bridges in general.

The loadings, clearances, widths, and some of the minor features of design reflect the requirements of present-day vehicles using the highways, and while it is recognized that the character of highway traffic is changing rapidly, it is believed that the bridges designed under these rules will be safe for any traffic reasonably to be expected on highways of the different classes.

State or municipal laws or local conditions may require loadings or unit stresses different from those set forth herein. To the extent that such requirements are more severe they must of course be followed, and that can be done without setting aside any of these rules which are not inconsistent therewith. To the extent that these rules are more severe than the requirement of local laws, these rules should be followed in the interests of good design and construction. It is hoped that the influence of these specifications will help along the tendency toward uniformity in legislative requirements.

Many of the paragraphs on design, materials and workmanship are identical with those of the General Specifications for Steel Railway Bridges, 1920, of the American Railway Engineering Association, and others have been modified slightly to suit the special conditions of highway bridges. It is recognized that highway bridges for modern heavy motor truck traffic should be on an equality with railways bridges in the matters of unit stresses, details of design, materials and workmanship and should differ only in the matters of loads and methods of applying and carrying the traffic.

(The specifications occupied 45 pages in the bulletin, too long obviously for presentation here. Editor.)

Discussion

(O. F. Dalstrom (C. & N. W.), chairman, presented the report of the committee and called attention to the supplemental report published under the date of February 12, which dealt with proposed revisions to the Manual. These revisions have been incorporated in the abstract presented above. On the motion by Mr. Dalstrom these specifications for the erection of railway bridges were adopted for inclusion in the Manual. The remainder of the report was accepted as information and the committee dismissed with the thanks of the Association.)

Report of the Committee on Rail

One feature of the report of the Committee on Rail which is always of general interest is the annual report of rail failures. True to predictions made during the war period, the records of rail failures for rollings under stress of war conditions are not as satisfactory as those of the three years preceding the war. Experience with the rail failure records has disclosed certain differences in the manner of filling out the form on which rail failures are recorded and has led the committee to prepare a new form which it is hoped will overcome these discrepancies in the manner in which the returns are made by the various roads. The committee also presented specifications for quenched carbon steel and alloy steel track bolts and for coiled spring washers for adoption by the association and inclusion in the Manual. Progress statements of work being done by the committee on the proposed increase in the length of rail, the relative wear of light and heavy rail on tangent track and on rail canting, were offered with a recommendation for the continuation of work on these subjects. The committee also reported progress on the studies of rail joint design and the design of 150-lb. rail sections. G. J. Ray has rounded out his fifth year as a chairman and his seventh year as a member of the committee.

G. J. Ray
Chairman

THE COMMITTEE PRESENTED rail failure statistics for the period ending October 31st, 1921, as Appendix A. The committee reported preparation and circulation of new forms 402E and 402F, presented as its Exhibts B and C. These forms provide for collection by quarters of all interior fissure failures together with the rail history, both at the mill and in the track.

ACTION RECOMMENDED

1. The committee recommended that the Rail Record Form 402-A, Rail Failures in Main Track, presented as

an Exhibit A, be adopted by the association and substituted for the form now published in the Manual.

2. The committee recommended that the Rail Record Forms 402-E, Interior Fissure Rail Failures in Track, and 402-F, Manufacturing Record Interior Fissure Rail Heats, presented as its Exhibits B and C, be adopted by the association for publication in the Manual.

3. The committee recommended that specifications submitted in Appendix B, Specifications for Quenched Carbon Steel and Alloy Steel Track Bolts, be adopted by the association and substituted for the specifications now published in the Manual.

4. The committee recommended that specifications submitted with this report as Appendix C, Specifications for Coiled Spring Washers, be adopted by the association and substituted for the specifications for Spiral Spring Nutlocks, now published in the Manual.

Committee: G. J. Ray (D. L. & W.), chairman; J. M. R. Fairbairn (C. P. R.), vice-chairman; E. E. Adams (U. P.), W. J. Backes (N. Y. N. H. & H.), F. L. C. Bond (C. N. R.), W. C. Cushing (Penna.), Dr. P. H. Dudley (N. Y. C.), J. B. Emerson, C. F. W. Felt (A. T. & S. F.), L. C. Fritch (C. R I. & P.), C. R. Harding (S. P.), J. D. Isaacs (S. P.), H. D. Knecht (M. P.), Hunter McDonald (N. C. & St. L.), R. Montfort (L. & N.), G. L. Moore (L. V.), J. R. Onderdonk (B. & O.), F. L. Thompson (I. C.), F. M. Waring (Penna.), Louis Yager (N. P.), J. B. Young (P. & R.).

Appendix A—Rail Failure Statistics For 1921

This report covers the rollings for 1916 and succeeding years, and the tonnages and track miles of rail represented by the statistics in this report are as follows:

Year Rolled	Tons	Track Miles
1916	1,162,837	7,820.14
1917	1,057,611	7,025.25
1918	944,899	6,313.98
1919	929,931	6,271.82
1920	1,118,187	7,374.71
1921	726,132	4,797.22

The average results of all the rails reported on are shown in Table 1, together with the results taken from previous reports including both Bessemer and Open-Hearth rails. The measure of the performance of the year's rolling is taken as the failures per 100 track miles for five years' service.

The remarkable record of rapidly decreasing failures, notwithstanding steadily increasing average wheel loads, was broken in the 1915 rollings, and the 1916 rolling shows another increase, which will undoubtedly be augmented by next year's record. Both the disturbed manufacturing conditions and roadbed under-maintenance, due to the war, are jointly responsible for this result.

Fig. 1 shows diagrammatically the general average results.

Table 2 presents the average weight of the rail rolled at each of the mills.

While the effect of war conditions will continue to be reflected in these reports for the next two or three years, it is believed that the intensive study of metallurgical practice in the production of gun and other fine steels, necessitated by the conflict, is now resulting in better rail mill practice. The combination of better steel with rehabilitated roadbeds should show in the not distant future better rail performances in track than we have ever known.

TABLE 1. AVERAGE FAILURES PER 100 TRACK MILES

Year Rolled	Years' Service 0	1	2	3	4	5
1908	...	....	....	.....	.....	398.1
1909	...	....	....	.....	224.1	277.8
1910	...	....	....	124.0	152.7	198.5
1911	...	....	77.0	104.4	133.3	176.3
1912	...	28.9	32.1	49.3	78.9	107.1
1913	2.0	12.5	25.8	44.8	69.5	91.9
1914	1.2	8.2	19.8	32.9	50.9	74.0
1915	0.7	8.9	19.0	34.2	53.0	82.4
1916	1.6	11.8	29.2	47.7	70.6	105.4
1917	5.3	21.6	38.9	66.0	110.5	.....
1918	1.6	8.9	27.6	54.0	.....	.....
1919	2.0	14.8	39.4	.....	.....	.....
1920	3.9	14.2	....	.....	.....	.....
1921	1.6	....	....	.....	.....	.....

TABLE 2. AVERAGE WEIGHTS OF RAILS COMPILED FROM TONNAGES USED IN THIS REPORT

Mill	1916	1917	1918	1919	1920	1921
Algoma	90.0	84.9	.....	90.4	100.0	102.3
Bethlehem	100.0	102.8	107.1	109.8	110.5	104.0
Cambria	103.1	118.9	120.7	105.4	121.2	125.3
Carnegie	101.1	99.4	100.6	106.6	104.9	107.9
Colorado	88.9	90.2	89.7	87.7	90.7	90.0
Dominion	....	....	85.0	85.0	.....	.....
Illinois	93.2	94.0	93.2	92.1	94.8	95.3
Lackawanna	95.2	97.4	95.5	94.9	96.6	108.9
Maryland	102.6	105.6	104.2	93.6	85.0	85.0
Pennsylvania	101.9	.....	100.0	100.1	101.2	100.0
Tennessee	87.7	87.1	87.5	88.7	88.4	88.0
Average	94.6	95.8	95.2	93.9	96.9	96.3

Appendix B—Specifications for Quenched Carbon Steel and Alloy Steel Track Bolts

(I) Materials

1. (a) The steel for the bolts shall be made by the open-hearth process.

(b) The steel for the nuts shall be made by either or both the following processes: Bessemer or open-hearth.

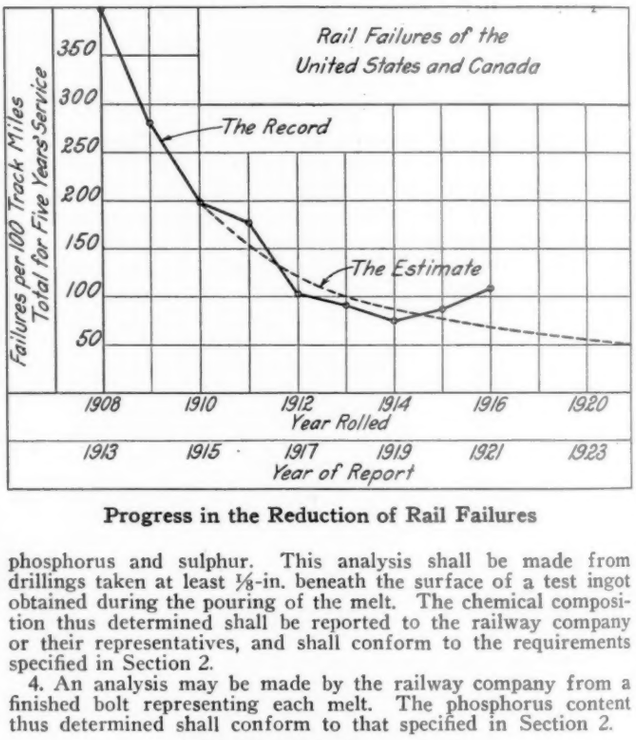
(II) Chemical Requirements

2. The steel for the bolts shall conform to the following requirements as to chemical composition:

Carbon—Not under 0.30 per cent.

Phosphorus—Not over 0.04 per cent.

3. An analysis of each melt of steel shall be made by the manufacturer to determine the percentage of carbon, maganese, phosphorus and sulphur. This analysis shall be made from drillings taken at least ⅛-in. beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the railway company or their representatives, and shall conform to the requirements specified in Section 2.



Progress in the Reduction of Rail Failures

4. An analysis may be made by the railway company from a finished bolt representing each melt. The phosphorus content thus determined shall conform to that specified in Section 2.

(III) Physical Requirements

5. (a) The bolts shall conform to the following minimum requirements as to tensile properties:

	Carbon	*Alloy-Steel*
Ultimate Tensile Strength, lb. per sq. in	100,000	110,000
Yield Point, lb. per sq. in.	75,000	85,000
Elongation in 2 in. per cent	10	12

(b) The yield point shall be determined by the drop of the beam or by the dividers, the method being optional with the inspector and at a cross-head speed not to exceed ⅛ in. per min. The tensile strength shall be determined at a speed not to exceed 1½ in. per min.

(c) The capacity of the nut in developing the full strength of the bolt shall be determined by a strip test. The threads must not strip when the bolt, with nut fully mounted, is tested in tension to its yield point, the load being applied to the head and the outside of the nut.

6. Full-size bolts shall bend cold through 45 deg. around a pin, the diameter of which is equal to the diameter of the bolt, without cracking on the outside of the bent portion.

7. Tension test specimens shall be taken from the finished bolts and shall conform to the dimensions of the A. S. T. M. standard test specimen. The ends shall be of a form to fit the holders

of the testing machine in such a way that the load shall be axial.

8. (a) One tension, one bend, and one strip test shall be made from each lot of 50 kegs or fraction thereof.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 6 (a) and any part of the fracture is more than ¾ inch from the center of the gage length, as indicated by scribe scratches marked on the specimen before testing, or if the bend test specimen breaks in the threaded portion, a re-test shall be allowed.

(IV) Design and Tolerance

9. The bolts and nuts shall conform to the dimensions specified by the Railway Company subject to the following variations: A variation of 1/32 in. under and 1/64 in. over the specified diameter of the shank of the bolt will be permitted. The diameter of the shank shall not be below the diameter of the rolled thread by more than 1/16 in. for bolts ⅞ in. in diameter and under, nor more than 3/32 in. for bolts 1 in. in diameter and over. The length of the bolt under the head shall not vary more than ⅛ in. from that specified. A variation in the dimensions of the elliptical shoulders under the head of 1/32 in. will be permitted.

(V) Manufacture

10. The bolts and nuts may be neatly formed and free from fins or nicking. The head of the bolt shall be concentric with and firmly jointed to the shank, with the under side at right angles to the axis of the bolt. The threads shall be sharp and true to gage and may be rolled or cut. The nuts shall have a hand free fit on the bolt from four to six turns and tight with a 15-in. wrench the balance of the screw length without distorting the threads. They shall be screwed on the bolts before packing a sufficient number of turns to hold them in place until used. The bolts shall enter the quenching medium at a temperature of not less than 790 deg. C. (1,450 deg. F.).

11. The finished bolts and nuts shall be free from injurious defects and shall have a workmanlike finish.

(VI) Inspection

12. The inspector representing the railway company shall have free entry at all times, while work on the contract of the railway company is being performed, to all parts of the manufacturer's works which concern the manufacture of the bolts and nuts ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the bolts and nuts are being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

13. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 4 shall be reported within five working days from the receipt of samples.

(b) Bolts and nuts which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected and the manufacturer will be notified.

14. Samples tested in accordance with Section 4 which represent rejected bolts shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the test, the manufacturer may make claim for a hearing within that time.

(VII) Shipment

15. (a) A letter or brand indicating the manufacturer and the initials "H T" shall be pressed on the head of the bolt when it is formed.

(b) All containers shall be marked by the manufacturer as follows:

(1 Name of manufacturer.
(2) Material (carbon or alloy steel).
(3) Size of bolts (diameter and length).
(4) Weight.

Appendix C—Specifications for Coiled Spring Washers

(I) General Scope

1. These specifications cover two classes of coil spring washers: High spring pressure, and low spring pressure or common coil spring washers. These classes are entirely distinct in intensity of spring pressure and the railway company will instruct the inspectors under which class inspection shall be made.

(II) Materials

2. Material for coil spring washers shall be of a carbon steel or an acceptable alloy steel, manufactured by the Basic or Acid Open-Hearth Process, the Electric Furnace Process, or the Crucible Process.

(III) Chemical Requirements

3. The chemical composition of the spring washers manufactured from each melt of steel shall be within the following limits:

Phosphorus—Not to exceed 0.05 per cent.
Sulphur—Not to exceed 0.04 per cent.

(IV) Physical Requirements

Spring Pressure.—4. After test specimens have been subject to the preliminary loads of the following table for three successive times, they shall withstand the test loads stipulated without becoming compressed to within .01 inch of solid height.

	High Spring Pressure		Low Spring Pressure	
For Diameter of Bolts in Inches	Preliminary Load in Pounds	Test Load in Pounds	Preliminary Loading	Test Load in Pounds
¾	15,000	5,000	Down to Solid	750
⅞	20,000	7,000	Down to Solid	1,000
1	28,000	8,000	Down to Solid	1,500
1⅛	36,000	10,000	Down to Solid	2,000
1¼	45,000	12,000	Down to Solid	.....

Reaction.—5. After test specimens have been subjected to preliminary loads as in Section 4, their reaction shall not be less than two-thirds the height or thickness of section, provided thickness is less than width of section. If the section is square, the reaction must not be less than one-half its thickness. If height or thickness of section is more than its width, reaction shall not be less than the width of section.

Fracture Test.—6. When test specimens are slowly twisted until broken, the structure at the fracture must be of fine grain, homogeneous, or of uniformly silky structure.

Hardness.—7. The test specimens shall show hardness on Brinell scale of between 400 and 475.

Temperature of Test Specimens.—8. The temperature of specimens at time of testing shall be between 60 and 110 deg. F.

Proportion of Tests.—9. (a) Tests shall be made of specimens selected by the inspector at random from lots of not over 15,000 pieces of finished product offered for inspection. Two specimens shall be selected for each test (pressure, fracture, and hardness), and if both meet the requirements of the specifications, the lot will be accepted. If one of the specimens fails, a third shall be selected and tested, and if it meets the requirements of the specifications, the lot will be accepted. If, however, the third test piece fails, the lot will be rejected.

(b) When required, the manufacturer shall furnish samples from a preliminary lot before proceeding with the fulfillment of the order and give sufficient notice in advance of the date when they will be ready for inspection.

Reheat Treatment.—10. (a) If the results of the physical tests do not conform to the requirements specified, the manufacturer may reheat-treat each lot, but not more than three additional times, unless authorized by the railway company, and retests shall be made as specified in Section 9.

(b) No lot which has failed to pass the tests shall be offered for further test until after the spring washers in that lot have been re-treated.

(V) Design and Tolerance

Design.—11. Spring washers shall be made in accordance with the standard sizes, dimensions and forms, as specified by the railway company.

Tolerance.—12. The weight of finished spring washers per thousand lot shall be at least 97 per cent of the theoretical weight, the weight of a cubic inch of steel being taken as 0.2833 lb.

(VI) Manufacture

13. (a) Previous to offering any lots of spring washers for inspection, each individual piece shall have been subjected as a part of the routine manufacturing process to shock or pressure sufficient to eliminate permanent set and any individual pieces defective through seams, quenching cracks, etc.

(b) Heat treatment shall conform to the best known methods for securing the desired physical properties.

(c) All spring washers must be clean, smooth, without burrs or rough edges, of uniform size, with well shaped symmetrical coil and cross-section, free from injurious mechanical defects, and be finished in a first-class, workmanlike manner.

(VII) Inspection

Place of Tests.—14. All tests and inspection shall be made at the place of manufacture prior to shipment, except that check tests may be made at any other place selected by the railway company without holding the manufactured articles at the mill awaiting the results of the check tests, and shall be so conducted as not to interfere unnecessarily with the operation of the mill.

Access to Works.—15. Inspectors representing the railway company shall have free entry at all times, while the contract is being executed, to the works of the manufacturer, and shall have all reasonable facilities afforded by the manufacturer to satisfy them that the spring washers are furnished in accordance with the terms of these specifications.

Defects Found After Delivery.—16. Spring washers to the extent of five per cent or more of the order which show injurious defects subsequent to their acceptance at the place of manufacture or sale will be rejected and returned to the manufacturer, who shall pay the freight charges both ways and replace the defective spring washers with new ones fulfilling the requirements of the specifications.

(VIII) Shipment

Packing and Branding.—17. (a) The finished spring washers shall be packed in quantities of 1,000 or 1,500 in securely hooped kegs or well fastened boxes. Containers shall be left open until the inspection is completed.

(b) All containers shall be marked by the manufacturer as follows:

(1) Name of manufacturer.
(2) Class (high spring pressure or low spring pressure).
(3) Size of spring washers (inside diameter, width and thickness).
(4) Number of spring washers.

The report was presented by J. M. R. Fairbairn (C. P. R.) vice-chairman.

Discussion

J. B. Emerson: At the time the Rail Committee report was prepared last November, there had only been four rollings. Since that time additional steel has been rolled under this specification, amounting in all, so far, to about 75,000 tons or about 800 heats rolled for eight different roads at six different mills. We are trying to test out whether a minimum silicon requirement of 0.20 will consistently give us tougher metal in the rail head than we are getting from a silicon minimum of 0.10. The results as tabulated indicate that the heats so far rolled when classed by their respective carbon contents show quite consistently a very high order of toughness. We are measuring toughness by stretching the rail head down under the drop until it breaks and measuring the amount of the stretch. All heats rolled under this experimental specification show ductivity above the six per cent requirement of the 1915 A. R. E. A. specification and only one heat fails to exhibit sufficient ductivity to enable it to pass the present A. R. E. A. standard specifications of 1920, to which no commercial rollings have ever been made on account of the price penalty imposed by the manufacturers, undoubtedly due to the difficulty of commercial production of rail to its requirements. The experimental specification does not include a nick and break test to determine laminations along the neutral axis of the rail which are not evident at the bolt holes. Such nick and break tests as have been made on the high silicon rail do show some increase in lamination of this character above the amount found on lower silicon metal. The results are not presented as sufficient in the judgment of the committee to warrant our recommendation at present of adoption of the experimental specification as standard, but do present a strong argument for the collection of an increased volume of data through large rollings during the coming year.

Vice-chairman Fairbairn: Before moving the adoption of rail record Form 402-A, I would like to say that the committee is very grateful for some suggestions made to it by E. R. Lewis (M. C.), and having considered those suggestions fully, is prepared to accept all of them and to incorporate them in the form. They consist mostly of minor changes in wording which all tend to make the answers more easy on the part of the section foremen. The committee is prepared to accept all of Mr. Lewis' suggestions with the single exception of his definition of an ordinary break, which we feel is better covered by the wording that we have in our own form. *I would move the adoption of Form 402-A as amended by Mr. Lewis' suggestion as to wording.*

(*Motion lost.*)

(Following this vote a motion to refer this back to the committee for further consideration was carried. This was followed by a long discussion participated in by G. H. Bremner (C. B. & Q.), C. W. Baldridge (A. T. & S. F.), H. R. Safford (C. B. & Q.), C. C. Cook (B. & O.), Hunter McDonald (N. C. & St. L.), W. C. Cushing (Penn.), W. R. Armstrong (U. P.), and E. H. Lee (C. & W. I.), after which a motion by Mr. Safford to reconsider was passed and the original motion to adopt Form 402-A was then carried. Vice-chairman Fairbairn moved adoption of Recommendation 2, relating to rail record forms 902-E and 402-F, Recommendation 3 relating to Appendix B, and Recommendation 4 relating to Appendix C, which were carried. The committee was dismissed with the thanks of the association.

Report of the Committee on Standardization

The Committee on Standardization has for its principal object the more extensive utilization, by the railroads, of the standards adopted by the association and included in the Manual. In this work it has co-operated closely with two other organizations of kindred interest, the American Engineering Standards Committee and the Division of Simplified Practices of the Department of Commerce. Efforts have also been directed towards greater co-operation between committees of the American Railway Engineering Association and representatives of other organizations directly concerned with the same materials and practices with the idea that joint specifications could be drawn which would be satisfactory to the two or more organizations. The report of the committee, as presented in abstract below, points to the progress which has been made in standardization in foreign countries, notably in Germany and England, as well as in Canada. Progress is reported in the submission of the association's Specifications for Steel Railway Bridges and the Specifications for Movable Railway Bridges to the American Engineering Standard's Committee for adoption as standard. E. A. Frink has been chairman of this special committee since its organization four years ago and is a stanch advocate of standardization.

E. A. Frink
Chairman

THE PROSPECT OF STANDARDIZATION is improving from year to year. Progress in other countries is noteworthy, that in Germany being perhaps the most productive. The British Engineering Standards Association, formed in 1901, has likewise made noteworthy progress. Standardization is also progressing in Canada, where the Canadian Engineering Standards Association was formed in 1919, and although not a government institution, is recognized by the Canadian Government.

In other countries much progress is being made, although it is not as great as in Germany and England. In this country, progress in general standardization has been slower, although the Mechanical and Signal sections of the A.R.A. have done noteworthy work in this direction. This year Secretary Hoover has started a campaign along the same lines establishing his Division of Simplified Practice under the direction of William A. Durgin. A working arrangement has been made between this Division of Simplified Practice and the American Engineering Standards Committee, whereby each assists in and supplements the work of the other. Your committee has endeavored as far as possible to keep in touch with the progress of this work, and the association has, at the present time, 29 members serving as representatives and alternates on committees.

O. F. Dalstrom, advised on September 30 that the Committee on Iron and Steel Structures had adopted a resolution to submit "Specifications for Steel Railway Bridges" and for "Movable Railway Bridges," with recommendation that they be submitted to the American Engineering Standards Committee for action. The plurality vote of our committee being in favor of submission of these specifications to the procedure of the American Engineering Standards Committee, the matter was presented to the Board of Direction for action on October 25, the final result of vote being transmitted on November 2.

The committee feels that much good will result from the work of the A.E.S.C. and recommends a very close coöperation between this association and the A.E.S.C. in order that standardization work, as far as possible, may be conducted along lines that are favorable to our interests.

Committee: E. A. Frink (S. A. L.), chairman; J. R. W. Ambrose (Toronto Term.), vice-chairman; W. C. Barrett (L. V.), F. L. C. Bond (C. N. R.), G. D. Brooke (B. & O.), W. A. Clark (D. & I. R.), O. F. Dalstrom (C. & N. W.), A. F. Dorley (M. P.), (W. T. Dorrance (N. Y. N. H. & H.), W. J. Eck (Sou.), J. M. R. Fairbairn (C. P. R.), W. D. Faucette (S. A. L.), Maro Johnson (I. C.), C. E. Johnston (K. C. S.), Edwin B. Katte (N. Y. C.), C. M. McKay (K. & M.), A. Montzheimer (E. J. & E.), F. E. Morrow (C. & W. I.), G. J. Ray (D. L. & W.), A. O. Ridgway (D. & R. G. W.), Edward C. Schmidt (U. of I. H.), F. J. Stimson (Penna.), H. M. Stout (N. P.), C. M. Taylor (C. of N. J.), C. C. Westfall (I. C.), W. P. Wiltsee (N. & W.).

The report was presented by E. A. Frink (S. A. L.), chairman.

Discussion

A. W. Whitney (A. E. S. C.): The American Engineering Standards Committee was formed about four years ago. It has 135 projects under way, of which 35 are approved standards; it has 205 national associations represented on its committees, or 1,000 individuals. We have an office staff of 12 persons, but the amount of work that needs to be done is so great that we could double our staff over night and keep them busy. Perhaps the two most significant things to say about the operation of the A. E. S. C. are negative, things that it does not do; it does not initiate standardization projects and it does not do standardization work itself. I have the greatest respect for the fine standardization work that the railroads have done, pioneer work that long antedates the great body of other standardization work in this country. I can readily see how the magnitude of the field that you cover makes you feel that your work can be carried on to a large degree independently. But I am convinced that this is a fallacy. No interest is so large that there are not interlocking and overlapping interests that must be harmonized unless there is to be a real loss of economy.

J. A. Capp (A. E. S. C.): I am going to read a reply that was made recently to a request from Secretary Hoover as to the reasons for his program of standardization and simplification: "In many lines of engineering the practice has grown up for separate organizations to draw specifications of their own to which material is purchased. In a great many instances these specifications are fully, or in the major part, identical with the specifications issued by other organizations. Differences when they occur are frequently, and perhaps generally, of a minor character and altogether too often require only a slight modification in the product which the specification covers. This practice (which can, of course, be defended in many instances) has, in a very large number of cases, resulted in higher costs to the purchaser without any corresponding gain in the quality of material." The railroad problem is not a problem peculiar to the railroads, and the railroads in free discussion with other industries, having problems more or less similar, can help the others. Each can aid the other and the general result will be to the advantage of all in standardization.

Chairman Frink: This matter, it seems to me, is one of the most vital and important that is before the Association today, and it also seems to me that the efforts of your Standardization Committee will be very largely tied up with the American Engineering Standards Committee.

C. A. Morse (C. R. I. & P.): As far as the main problems of maintenance of way and structures are concerned on a railroad, they are problems of their own. As far as they use things in a minor degree that are used in general in other places, standards that are used for these other classes of business should be adopted, but it seems to me that we are trying to spread ourselves out too thin. If after 24 years we have not gotten together to any larger degree than the president's address would indicate today of using straight railroad standard material, we have plenty of work to do to attend to that.

R. H. Ford (C. R. I. & P.): I don't think that the railroads realize, in dollars and cents, what it means sometimes to get a common standard. For example, this last year I was told by the manufacturer of a labor-saving device that we could cut the cost $500 if it were not for the fact that all of the railroads insisted on having different ballast sections.

Edwin B. Katte (N. Y. C.): The impression I have of the Engineering Standards Committee is that there is a great deal of machinery and its work is thorough and it takes a very long time to arrive at results. I advocate continuing our membership if it does not involve more than the annual dues for the member, $500 per member. I understand that a new method of finance is under consideration, perhaps been adopted. The interests are to subscribe a certain percentage. It might be $25,000 from the railroads and $25,000 from the industries. Our donations would be 50-50 and our vote would be something like 1 in 20 or 1 in 27, and so, if we go along with this committee, which I hope we will, it should be made clear that our going along is only as individual members and that the matter of financing is entirely a different subject, which would be handled exterior to the Association.

O. F. Dalstrom (C. & N. W.): The American Engineering Standards Committee is a permanent organization. It will go ahead with its work and standardize articles and specifications, whether the A. R. E. A. is a member or not. The A. R. E. A. is interested in having representation on the A. E. S. C. If it has no representation there, it is not in a position to defend its rights or to present its views, or to bring to bear its influence in shaping standards in accordance with the railway interests.

Chairman Frink: Reference has been made to the slowness with which the A. E. S. C. works. The A. R. E. A. has produced a lot of valuable work, but how many years did it require? The A. E. S. C. has been working

for about three years, and no more. The question of financing the A. E. S. C. and the question of membership by the A. R. A. or the A. R. E. A. are separate propositions, and one has nothing to do with the other. The A. R. A. has one membership, for which they pay $500 and the traveling expenses of a representative. If the A R. E. A. takes a membership, they also will be called upon to spend $500 and traveling expenses of representative. After the memberships are taken by these associations, the railroads in the A. R. A., as individuals, will probably be asked to contribute their quota. If they do so, all right; if they do not, that is also up to them—they can subscribe or not. That has nothing to do with the membership of the A. R. E. A.

(The committee was dismissed with thanks of the Association.)

Report of the Committee on Masonry

The Committee on Masonry presented reports on two subjects, neither of which was intended for inclusion in the Manual. Nevertheless, they represent valuable information. The first was a report on factors causing the deterioration of concrete, based on reports obtained from various sources on defects found in existing railway structures. The second was in the nature of a progress report, which has formed a regular part of the Masonry Committee's work for several years, namely, reports on current developments in the art of mixing concrete. The present report recorded progress being made in the practical application of scientific facts.

C. C. Westfall
Chairman

C. C. Westfall, the new chairman of the committee, has served on the committee for the last four years. He also represents the association on the Joint Committee on Concrete and Reinforced Concrete. As bridge engineer of the Illinois Central, a road which has been one of the leaders in the application of reinforced concrete to railway structures, he has had ample opportunity to gain a thorough knowledge of masonry design and construction, the subjects in which this committee is most interested. Mr. Westfall has been in the employ of the Illinois Central since 1907, his experience having been almost entirely in bridge design and construction.

THE COMMITTEE recommended the following action on its report:

1. That the report given in Appendix A, relating to factors causing deterioration of concrete structures, be accepted as information and be published in the Proceedings.

2. That the report given in Appendix B, relating to the development in the art of making concrete, be accepted as information and published in the Proceedings.

Committee: C. C. Westfall (I. C.), Chairman; T. L. D. Hadwen (C. M. & St. P.), Vice-Chairman; J. T. Andrews (B. & O.), R. Armour (C. N. R.), T. L. Condron (Con. Engr.), W. A. Christian (City of Chicago), A. O. Cunningham (Wabash), J. R. Freeman (Con. Engr.), S. C. Hollister (Con. Engr.), F. A. Howard (Erie), Richard L. Humphrey (Con. Engr.), S. A. Jordan (B. & O.), Paul Kircher (Con. Engr.), W. S. Lacher *(Railway Age)*, J. A. Lahmer (M. P.), C. P. Richardson (C. R. I. & P.), F. E. Schall (L. V.), Z. H. Sikes (N. Y. C.), D. A. Tomlinson (Portland Cement Assn.), Job Tuthill (P. M.), J. J. Yates (C. of N. J.).

Appendix A—Factors Causing Deterioration of Concrete Structures

In making investigation of this subject, the committee sent out a questionnaire requesting information as to specific cases where concrete had deteriorated from causes other than faulty materials or workmanship. Replies were received from 42 railroads, but in the majority of cases it was reported that there had been no experiences of the kind falling within the scope of this investigation; however, some reports were received which were pertinent.

The importance of securing a high quality of concrete is well understood. The committee feels that it would merely be a repetition to mention these, for which reason they were eliminated from the questionnaire. Instances where lack of hydration due to atmospheric conditions or other causes have prevented the concrete from attaining its full strength have been called to the attention of the committee; but they were not believed to come freely within the scope of this investigation.

It is possible that a careful study of the reported cases, where deterioration of concrete has been observed, will reveal the fact that different design or methods of construction would have eliminated much of the trouble. They will serve to point out, however, the need for care under these conditions.

A general outline of the cases of deterioration reported indicate that the destructive agencies fall on three general groups, chemical, mechanical and thermal or meteorological. In many cases, however, the deterioration is probably due to a combination of two or more of these.

Under the classification of factors of a chemical nature are cases where concrete has been affected by acid, alkali or sea water action. Of the specific cases reported, the most notable are those of tunnel linings and bridge masonry attacked by acid. In the case of tunnels, the concrete has been seriously damaged at points where seepage has tended to keep it wet and thereby more liable to attack by the locomotive gas. The chemical reactions taking place cause the concrete to become soft and pasty and this effect is cumulative, the action gradually extending deeper into the concrete. Where seepage does not occur, this action does not take place, or at least to only a very limited extent. In one case reported, the seepage consisted of mine drainage, which in itself was highly acid, but this, while probably aggravating the adverse conditions, had practically the same general results as where such seepage was not of an acid nature.

Several cases were reported where concrete bridge and culvert masonry was affected by water of streams carrying free acid. The concrete gradually softened and crumbled away, having been cut back 6 in. or 7 in. in some instances. The percentage of free acid which will produce such deterioration has not been determined. Other cases where acid was at least a contributing fac-

tor occur in the deterioration of deck slabs and parapet walls where seepage contains acid from cinders or brine drippings, and also in cinder pits where the water used is generally made highly acid by the hot cinders.

The second general cause of deterioration, namely mechanical, will generally be found to be of an abrasive nature. The blast from locomotives has been found to have a destructive effect, and while this may have been a slight contributing factor in the cases of tunnels, the most notable cases where deterioration can be ascribed to this cause are of overhead bridges, either having solid slab floors or steel encased in concrete; low overhead clearance will intensify the effect and the action of seepage will also contribute to the deterioration.

Abrasive action of clam shell buckets, such as used in cinder pits, and of ice and other floating objects will also come under this classification, and, in the presence of other adverse factors, will hasten the destructive effect. These latter factors together with wave action itself are undoubtedly responsible to some extent for deterioration of sea coast structures.

The third general cause, of a thermal nature, might in some cases be called meteorological, especially in the case of freezing. The first sub-factor, heat, as a contributing cause to deterioration, is exemplified in conditions that prevail in cinder pits, where the concrete is subjected to frequent and extreme variations of temperature. It is probable that this thermal action in itself would have a deleterious effect on the concrete, but the destructive effect is usually hastened by chemical and mechanical action.

With regard to freezing, it is difficult to definitely establish cases where this alone has caused deterioration in well-made concrete. Where initial deterioration has set in from some other cause, freezing will, of course, continue the destructive action.

Seepage of water is probably one of the worst enemies of concrete and is a large contributing factor in many cases of deterioration. It is the action of the seepage which permits other factors to exercise their adverse effect, although of itself it is not particularly destructive. Usually seepage occurs from the back of the masonry, although moisture may enter the body of the concrete through hairline cracks. In such case, the destructive effect will be most marked in reinforced concrete where rusting and corrosion is started. In this connection, it should be noted that seepage will usually indicate lack of density, which may be due to poor workmanship, poor proportioning or from some other cause, such as construction joints or difficult conditions of placing.

Protective measures have been adopted for resistance to attack by the various agencies above cited, but the degree of success obtained by these already used in a number of cases cannot as yet be definitely determined. Where the concrete is attacked by some exterior agency, such as acid water or gas, sea water, or the abrasive action of ice or locomotive blast, the concrete may be surfaced with a protective material less subject to the destructive action. This has been done in tunnels by placing hard-burned brick in front of the concrete and at other structures a sheathing of timber or stone has been used. The placing of a coating with a cement gun will also create a hard dense surface which will, to a large extent, resist the destructive action. This latter expedient has been used very successfully in several cases of overhead bridges where the original concrete had suffered serious deterioration. Considerable effort is also being made to obtain a hard and impermeable surface by use of surface washes and integral compounds, but to date results obtained are somewhat uncertain, and it is probable that sufficient care used in obtaining a dense concrete would bring about a more desirable result.

In cases where the initial deterioration is due to seepage, the remedy would seem to lie in the proper waterproofing of the structure or in the proper designing to permit a speedy escape of the water before it enters the body of the concrete. While this is entirely practicable for structures such as bridges and arches, it constitutes a difficult problem in long tunnels.

A case for which it is also difficult to provide a remedy is presented by concrete cinder pits. The combined action of heat, abrasion and acid water will attack a structure of almost any type and apparently the only action to be taken is to provide for a sufficiently heavy and strong design to resist the destructive agencies for a maximum period.

As this subject covers only factors which enter into the deterioration of concrete, the committee wishes to again emphasize its belief that deterioration may be lessened to a considerable extent, and in some cases altogether avoided, by the closest possible adherence to the best practice in concrete design and construction.

Appendix B—Developments in the Art of Making Concrete

During the past four years the committee has presented information relative to the more important developments in the art of making concrete, and in this connection has submitted data showing the results of extensive laboratory tests. The more important developments relate in greater part to the factors of strength and uniformity of concrete work. These may be summarized as follows:

1. Quantity of mixing water, and its relation to the resultant strength of concrete, with a discussion of the "water-cement ratio." 2. Uses of the slump test and the flow table. 3. Time of mixing and the speed of rotation of mixing drum, and their relation to the strength of concrete. 4. Sieve analysis and its uses. 5. Colorimetric test for sand and its uses. 6. Effect of proper curing conditions upon the strength and durability of concrete.

Users of concrete, as a general rule, have given careful attention to laboratory tests and the advice issued by the laboratory, but when on the work it is often noted that there is an inclination to return to their usual practice, which from past experience, seemed satisfactory. The entire disregard of such advice often leads to inferior work, but on account of the relatively small number of tests of field concrete generally made, the results of such inferior work are not, as a rule, impressed upon the memory of the user at the time the work is under way, and for this reason, the matter generally escapes his attention.

In recent years, however, the rapidly increasing use of concrete for all classes of masonry now demands an intensive investigation of the economics of its design and construction, and the advancement in the art gained from laboratory studies must be given cognizance by every engineer engaged in the use of concrete. The wide publicity given to the injurious effect of excess mixing water has led to a reduction in the quantity of mixing water used, and a gradual adoption of the slump test as a means of controlling the water content. Similarly, the colorimetric test for organic impurities in sands is extensively used and more attention being given to modern methods in connection with the care of concrete during the hardening period.

An increasing number of specifications for concrete pavements now contain clauses providing for the use of the slump test and the limiting of the slump to a small amount (usually less than 2 in.), the specifications of 15 state highway departments having been noted as requiring this test. Similarly, many highway specifications

include the use of the colorimetric test and a protection during the early hardening period, either by covering the pavement with damp sand or by flooding it with water. Tests for the grading of aggregates and the determination of economic proportions are also coming into use and are of great value.

However all cases brought to light have concerned the general uses of concrete rather than those pertaining directly to the railroads. This, however, does not evidence any lack of appreciation of the development work now being done by a number of railway companies. The committee contemplates a review of this work during the coming year.

Discussion

J. T. Andrews (B. & O.), chairman of the sub-committee, outlined the report on Factors Causing Deterioration of Concrete Structures, which was received as information for publication in the Manual.

G. A. Mountain (Canadian Railway Commission): I just want to ask the committee one question. It states alkali may have an adverse effect on the concrete, "acting either through the medium of seepage water or direct ground contact, but the committee has not had reported to it any well defined cases of this nature."

I might say that in our Northwest Provinces of Canada a great deal of trouble has been encountered and the Scientific Industrial Research Council of Canada delegated men to look into it. I am inclined to think from my own knowledge it might be direct ground contact, but it is still a subject worthy of looking into.

Mr. Andrews: In connection with alkali, the committee was aware of a number of reported cases, but, as we pointed out in our report, the committee did not have reported to it any well defined case of this nature and our information regarding it was purely tentative.

C. P. Richardson (C. R. I. & P.) next outlined the report on Developments in the Art of Making Concrete which was received as information, completing the Report on Masonry.

(The committee was dismissed with the thanks of the Association.)

Report of the Committee on Ballast

The mechanical tie tamper as a factor in maintenance of way work was given an important part in the report of the Committee on Ballast. In Appendix A the committee submitted tables of cost data on pneumatic tamper performance on four railways. In Appendix B it presented a detailed discussion of practices in the operation of mechanical tampers and submitted as recommended practice a summary of the care of mechanical tampers. Specifications and plans for a ballast shovel were presented for adoption and inclusion in the Manual, being a revision of similar matter presented in preliminary form last year. Similarly, a standard cross section for gravel ballasted track was submitted for approval. In Appendix C the committee presented a report on the size of stone ballast and suggested that the subject be continued. In its recommendations for future work for the committee the use of concrete slab foundations for track and crossings is suggested. This subject has been given a considerable impetus by the work now being done at the new Chicago Union Station. The chairman of this committee, F. J. Stimson, has directed its work for the past two years, after serving as vice-chairman for one year. He has had a long record on this committee, having served continuously for the last 17 years.

F. J. Stimson
Chairman

THE COMMITTEE RECOMMENDED the following action on its report:

That a report on the cost of applying ballast, presented in an Appendix "A," be received as information and the subject closed for the time being.

That the specifications and plan for a ballast shovel, amended as shown in Appendix "B," be adopted as recommended practice.

That a report on the size of stone ballast, presented in Appendix "C," be received as information, and the subject continued.

That the rules for "Care of Mechanical Tampers," as given in Appendix "D," be adopted as recommended practice.

That the ballast section for gravel ballasted track, shown in Appendix "E," be adopted as recommended practice.

Committee: F. J. Stimson (Penna.), Chairman; G. H. Harris (M. C.), vice-chairman; C. W. Baldridge (A. T. & S. F.), O. F. Barnes (Erie), Theo. Bloecher Jr. (B. & O.), H. E. Boardman (N. Y. C.), R. R. Bragg (C. R. I. & P.), C. J. Coon, (G. C. T.), C. E. Dare (W. S.), M. H. Doughty (D. L. & W.), Paul Hamilton (C. C. C. & St. L.), K. H. Hanger (M. K. T.), A. G. Holt (C. M. & St. P.), F. A. Jones (M. P.), J. S. McBride (C. & E. I.), W. C. Reisner (C. & A.), Hans Schantl (M. R. & B. T.), M. A. Stainer (F. W. & D. C.), Paul Sterling (N. Y. N. H. & H.), D. W. Thrower (I. C.), P. H. Winchester (N. Y. C.), Lef Winship (M. P.).

Appendix B—Ballast Shovel

The Committee submitted a revision of the plan of the Wooden "D" handled shovel reported as information at the last meeting of the Association to conform with the provisions of the specifications.

This committee had studied the features of the specifications submitted last year (see *Railway Age* for March 15, 1922, page 633), relating to Brinell tests, and recommended that only a minimum test for hardness be retained in the specifications, and that a test for brittleness be added to take the place of the maximum Brinell test.

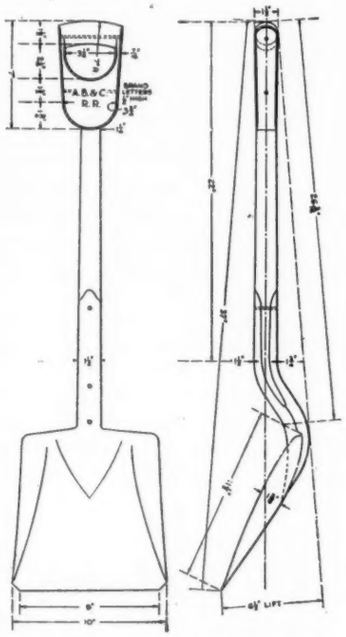
Paragraph 11 of the Specifications for Ballast Shovels has been revised, and the revised paragraph is as follows:

Physical Properties.

All shovel blades shall show a Brinell hardness of not less than 300 and shall be tested for brittleness by placing the lower two inches of the blade in a testing machine, or vice, and applying sufficient pressure to flatten it out. After the pressure is removed, if the blade assumes its manufactured shape without failure, the blade shall be considered satisfactory.

Appendix D—Rules for Care of Mechanical Tamping Machines

Divide the territory upon which the mechanical tampers are to be operated into districts in each of which there is a sufficient number of tamping machines, section motor cars or other rail-



Ballast Shovel with Wooden D

way gasoline equipment to warrant employing a gasoline engine mechanic, whose duties would be to make a perodical inspection of all such equipment on his district; make light running repairs; supply small parts as needed; and instruct and advise foremen and operators in use of machines; this mechanic to carry a small supply of parts for light repairs, so that there may be no delay in the making of running repairs.

Select one or more central points where there are facilities for heavy repairs and general overhauling, which cannot be handled by district gasoline mechanics, to which equipment may be sent for heavy repairs when needed or for general overhauling during seasons when equipment is not in use, establishing at such point or points, if possible, a staff of mechanics belonging to the maintenance of way organization. At such point or points carry a small stock of parts necessary for heavy repairs and overhauling.

Have all tamping equipment overhauled during winter months, so that it will be in first class condition at the beginning of the season's work.

It being desirable to provide sufficient work at the heavy repair points to hold the organization intact throughout the year, the overhauling of section motor cars, hand cars and other maintenance equipment should be undertaken during periods when the general overhauling of tamping equipment is not in progress.

Discussion

C. W. Baldridge (A. T. & S. F.), chairman of the subcommittee, presented Appendix A, Cost Studies Covering the Application of Ballast, which was received as information. Specifications for ballast shovels was then presented by A. G. Holt (C. M. & St. P.).

Mr. Holt: The specifications offered by the committee were submitted two years ago as information. There is very little change in the specification as submitted herewith, except in Par. 11, relating to the Brinell hardness. In the place of the text as is shown in the report, we ask that this paragraph be changed to read as follows:

11. All shovel blades shall show a Brinell test for hardness as follows:

(a) For alloy steel of not less than 470.

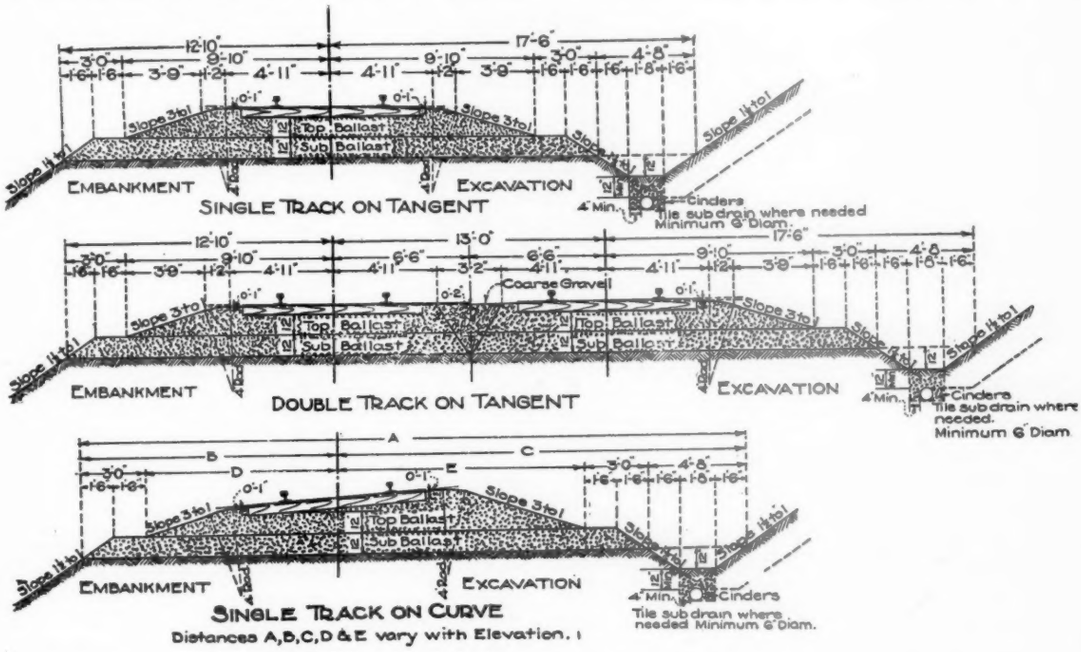
(b) For carbon steel of not less than 250, nor more than 300.

Alloy steel shovels shall be tested for brittleness by placing the lower two inches of the blade in a testing machine, or vise, and applying sufficient pressure to flatten it out. After the pressure is removed, if the blade resumes its manufactured shape without failure, it shall be considered satisfactory.

The plans for the shovel are similar to those presented a year ago.

F. J. Stimson (Penna.), chairman: *I move that the specifications as presented, with the substitution of the matter just read by Mr. Holt in Par. 11 be adopted as recommended practice.*

L. J. F. Hughes (R. I. & P.): Has the committee made any attempt to find out how much it would cost to have a shovel made according to these specifications. One of



Appendix E, Roadbed Sections for Gravel Ballast

the most important matters which has to be taken into consideration in making a standard is how much the thing is going to cost compared with the kind of tools we are now using.

Personally it would seem that information of that kind would be very valuable and it would be of interest to know if any steps along that line have been taken and if not, I think it should be done.

Mr. Holt: There have been no steps taken in regard to getting prices on the manufacture of this shovel, according to these specifications. However, the specifications have been submitted to several manufacturers and they report that there is no very great change in their present practice in making shovels, so I doubt very much if there would be any increase in the ordinary market price of the shovels.

(Motion carried.)

("Size of Stone for Stone Ballast," Appendix C, was then presented and received as information, after which Appendix D was presented.)

Chairman Stimson: *I move that the rules applying to the care of mechanical tampers as given in Appendix D be adopted for inclusion in the Manual for recommended practice. (Motion carried.)*

Chairman Stimson: The balance of Appendix D is presented as information only and need not be read. The next topic is Appendix E, Revision of Roadbed Section for Gravel Ballast. *I move that Appendix E be approved and printed in the Manual.*

Hunter McDonald (N. C. & St. L.): I do not know whether the committee has undertaken to present a standard which the railroads in this country can follow. When I tried to use one of the spreaders on the system I am connected with I found to make the wing fit I had to design it to suit the widths of roadbed that generally extended over the system. I assume that this section was probably adopted by having it used largely on the prairies, where the width of roadbed might possibly be almost unlimited.

We have gone now from an original roadbed section between shoulders of 20 ft. to 24 ft., and if it is intended to use this spreader on the side of the slope, my impression is we will be required to have wider cuts on the majority of the railroads.

Maurice Coburn (Penna.): I think this section is moving in the right direction, although it is somewhat of a hardship on some of the roads.

(Then followed some further discussion in the course of which Mr. Stimson offered further explanation of the committee's position. *His motion carried.* The Committee was then excused with the thanks of the association.)

Report on Shops and Locomotive Terminals

Last year the Committee on Shops and Locomotive Terminals presented a voluminous report on ash pits, including a long summary of recommended practice which was submitted for inclusion in the Manual. However, the discussion at the convention developed a general impression that the matter was presented in too extended a form to warrant its inclusion in the Manual and it was therefore received as information for publication in the proceedings. As a consequence of this action, the committee this year presented a new summary of ash pit practice in a much more condensed form, which was submitted for adoption and inclusion in the Manual.

F. E. Morrow
Chairman

However, it may still be considered that the matter presented in the report last year comprises supporting data which will be found of great value to anyone making a detailed study on the subject of ash pits. The work which this comparatively new committee of the association has done, in the brief period of its existence, together with its recommendation for future work, indicates that there is a large field for useful employment on matters which have hitherto received but little attention. The committee has in prospect studies of general layouts and designs of engine terminals, car shops, etc. F. E. Morrow has been chairman of the committee since its organization.

THE COMMITTEE PRESENTED a report on ashpits (Appendix A), and recommended that the conclusions relating to ashpits be approved for publication in the Manual, and that the recommendations covering ashpits, shown on pages 240 to 242 inclusive, in the chapter on buildings, be withdrawn.

Committee: F. E. Morrow (C. & W. I.), chairman; A. T. Hawk (C. R. I. & P.), vice-chairman; C. N. Bainbridge (C. M. & St. P.), G. W. Burpee (Con. Engr.), Leland Clapper (D. & I. R.), K. B. Duncan (G. C. & S. F.), G. H. Gilbert (Sou.), Walter Goldstraw (G. T.), E. M. Haas (Ferguson Co.), R. J. Hammond (B. & M.), G. W. Harris (A. T. & S. F.), R. L. Holmes (M. P.), Geo. W. Hand (C. & N. W.), L. P. Kimball (B. & O.), W. T. Krausch (C. B. & Q.), L. H. Laffoley (C. P. R.), J. M. Metcalf (M. K. & T.), J. W. Pfau, (N. Y. C.), L. K. Sillcox (C. M. & St. P.), John Schofield (C. N. R.), B. S. Voorhees (N. Y. C.), J. M. Weir (Nat. Boiler Wash. Co.), A. M. Zabriskie (C. R. of N. J.).

Appendix A—Ashpits

Ashpits and methods of ash disposal may be conveniently grouped in the following types:

(1) Ashes are discharged directly onto ordinary track construction and thence removed by hand.

(2) Ashes are discharged into small shallow pits with the rails supported either on non-combustible walls or metal ties.

(3) The depressed track pit, where engines discharge ashes onto a platform a few feet below the rails, from which the ashes are shoveled into cars on an adjacent depressed track.

(4) The deep water pit, where ashes are discharged into a pit 8 to 20 ft. deep, nearly full of water, from which the ashes are loaded into cars with clam shell buckets operated by various types of cranes.

(5) The shallow water pit where the ashes are discharged into long shallow pits constructed between the rails and nearly filled with water, from which the ashes are removed with clam shell buckets operated by overhead traveling cranes.

(6) Pits where ashes are discharged into hoppers or

a series of buckets, and thence removed by a great variety of mechanical means.

Track Layouts

The following features of track layouts are favorable to rapid handling of engines over ashpits and should be provided wherever possible:

(1) Sufficient track standing capacity at the approach ot the pit to accomodate all engines which may arrive in fleets in rush hours, and which cannot be immediately taken care of on the pit.

(2) Crossovers and other track connections to open yard or running tracks so that preferred attention may be given to any engine regardless of its time of arrival, and so that ash cars may be switched with a minimum interference with the movement of engines over the pit.

(3) Except at minor terminals, two or more tracks over the pit.

(4) Sufficient track space beyond the pit to enable the pit to be cleared of engines regardless of all other terminal work, particularly operations at the turntable.

(5) Track connections between the pit and turntable to allow engines to proceed outbound without using the turntable.

Capacity of Pits

Capacity may be defined as the number of engines that can be moved over a pit in a given period of time, and is determined for any given pit by the number of engines that can be accommodated on a pit at one time, and the average length of time the engines stay on the pit. The length of time an engine stays on the pit varies over a wide range, depending on the number of men cleaning the fire, the size of engine, kind of coal in the engine, length of run of the engine and the character of the fire cleaning performed, weather conditions, and unavoidable delays in moving engines after fires have been cleaned. Unless accurate information is obtained as to local conditions, for estimating purposes 45 min. may be used.

General Requirements

(1) A pit should be designed to meet the requirements of the rush hour, which should take into account abnormal conditions which may obtain due to engines arriving in fleets on account of delays on the road, unusual weather conditions, etc.

(2) The design should, so far as possible, take into account the destructive effect of hot ashes and sulphuric acid upon the parts of the structure exposed to contact with the ashes and water.

(3) All pits should be equipped with water pipes conveniently arranged for quenching fire and for attachments of hand hose for use of fire cleaners on each side of each engine.

(4) In cold climates a hot water supply under pressure is desirable to expedite the cleaning of frozen ashpans at the more important terminals.

(5) All pits should have proper drainage.

(6) All pits should be designed to provide as great a degree of safety as practicable.

(7) The work of removing ashes should be done mechanically so far as possible, to reduce the force employed to a minimum or to make the work easy and attractive to labor.

(8) Spare parts of mechanical equipment should be kept on hand, and, generally, no mechanical equipment should be used which cannot either be replaced or repaired quickly.

(9) Liberal storage space for ashes should be provided. At most terminals the switching of ash cars should not be necessary more than once a day. There is a decided advantage where ashes can be handled directly to a storage pile.

(10) The disposal of ashes should be so arranged as not to actually delay cleaning of locomotive fires and handling of engines over the pit.

Discussion

F. E. Morrow (C. & W. I.), chairman: The material presented in this report this year is rather brief, being a revision of the material that was presented last year on the subject of ashpits to complete that report.

(Chairman Morrow then presented the report and moved successively that the recommendations on ashpits be approved, that the section on track layouts, capacity of pits, general requirements and references be approved for publication in the Manual as recommended practice. Motions were carried.)

C. A. Morse (C. R. I. & P.): I notice we talk about "ashes" all the time. It is customary on most railroads to call them "cinders."

Chairman Morrow: The committee, in using the word "ashes" has followed out the terms of the assignment. The assignment was ash pits for the disposal of ashes. I am inclined to think the word "ashes" is a little broader than the word "cinders," although I believe that the speaker is correct in saying that "cinders" is a term more commonly used than "ashes." *I move that the subject under consideration be approved for publication in the Manual.*

(*Motion carried.*)

(The committee was dismissed with the thanks of the Association.)

Report of Committee on Signals and Interlocking

The committee recommended no changes in the Manual.

Sub-committees were appointed to confer with other committees of the Association as directed, but no matters of importance have arisen which have required co-operation on the part of these committees.

Committee: W. J. Eck (Sou.), chairman; W. M. Vandersluis (I. C.), vice-chairman; Azel Ames (Cons. Engr.), H. S. Balliet (N. Y. C.), A. M. Burt (N. P.), C. E. Denney (N. Y. C. & St. L.), F. L. Dodgson (Gen. Ry. Sig.), W. H. Elliott (N. Y. C.), G. E. Ellis (Aut. Train Con. Com.), H. K. Lowry (C. R. I. & P.), J. C. Mock (M. C.), F. P. Patenall (B. & O.), J. A. Peabody (C. & N. W.), A. H. Rudd (Penna.), A. G. Shaver (Cons. Engr.), T. S. Stevens (A. T. & S. F.), E. E. Worthing (S. P.).

Discussion

W. J. Eck (Sou.), chairman: This is a progress report only. The membership of this committee is practically identical with that of the Committee on Signaling Practice of the Signal section and any chairman of a standing committee of this Association knows, therefore, when he receives advice or help from a member of the Signal committee that he is receiving authoritative information as to the status of that particular subject within the Signal section. *I move that the report of the committee be accepted.*

(*Motion carried.*)

(The committee was dismissed with the thanks of the Association.)

Report of the Committee on Water Service

This report includes a set of specifications for water service work, presented in Appendix C, in which well digging and pipe laying were treated prominently. In Appendix H the committee presented an extended discussion of the relative merits of cast iron, wrought iron, wood and other pipe for use in railway service, consisting of a resumé of experience with different pipe materials and their classification with respect to their proper field of use. The subject of water analysis was taken up in Appendix G, in which the committee submitted forms of procedure both with respect to the analysis of waters and its interpretation, which form is recommended for adoption. The use of oil engines in pumping service was discussed in Appendix E, differentiating between the different types of engines, describing the operation of each and to some extent treating of their relative advantages. The committee reported progress in its studies in boiler corrosion and in Appendix D suggested the responsibility of railroads for pure drinking water by calling attention to recent court decisions finding corporations liable for sickness resulting from contaminated water. A. F. Dorley, district engineer, Missouri Pacific, has a long record of service on the Committee on Water Service, having been chairman continuously and a member for 12 years.

A. F. Dorley
Chairman

THE COMMITTEE RECOMMENDED the following action on its report:

That the changes recommended be made in the Manual.

That the report on progress of drinking water regulations be received as information, and that the subject be reassigned to the committee for further study and report.

That the final report on specifications for contracting water service work be accepted as information.

That the progress report on the study of pitting and corrosion of boiler tubes and sheets be received as information, and that the subject be reassigned for further study.

That a final report on oil engines in railway water service be received as information.

That a progress report on the value or water treatment to railways be accepted as information.

That a progress report on standard methods of water analysis be received as information and that the subject be reassigned.

That the final report on relative merits of cast iron, steel, wood and other materials for pipe lines be received as information.

Committee: A. F. Dorley (M. P.), chairman; C. R. Knowles (I. C.), vice-chairman; R. C. Bardwell (C. & O.), W. M. Barr (U. P.), S. C. Beach (I. C.), O. W. Carrick (Wabash), J. H. Davidson (M. K. & T.), H. G. Dalton (C. B. & Q.), B. W. DeGeer (G. N.), J. H. Gibboney (B. & O.), E. M. Grime (N. P.), R. L. Holmes (T. & P.), H. H. Johntz (M. K. & T.), C. H. Koyl (C. M. & St. P.), P. M. LaBach (C. R. I. & P.), E. G. Lane (B. & O.), Thomas Lees (C. P. R.), M. E. McDonnell (Pa.), E. H. Olson (A. T. & S. F.), W. M. Neptune (M. P.), A. B. Pierce (Sou.), H. L. Roscoe (Sou.), T. W. Sedwick (C. R. I. & P.), D. A. Steel (*Railway Age*), C. P. Van Gundy (B. & O.), F. D. Yeaton (C. M. & St. P.).

Appendix A—Revision of the Manual

The committee recommended the following revisions of definitions:

Oil Engine.—An internal combustion engine which is started and operated on a non-volatile oil of medium *low Baume degrees*, the fuel being ignited from a surface heated by previous combustion on the fuel.

Incrusting Solids.—Matter in solution or suspension which upon the application of heat forms scale.

Filtration.—A mechanical process for removing suspended matter or bacteria from water *by passing through sand or other close grained medium.*

Single-Action Pump.—One in which only one end of the plunger or piston acts on the fluid column.

Working Barrel.—The metal tube *or pump cylinder*, fastened to the lower end of the drop line and which contains the valves and piston.

Artesian Deep Wells.—Artesian deep wells, where obtainable, are a satisfactory source; however, their flow is liable to constant decrease and *final cessation.*

Appendix B—Regulations Pertaining to Drinking Water Supplies

An important ruling was made by the Ohio Court of Appeals on the subject of Drinking Water, September 12, 1921, to the effect that corporations were to be held directly responsible for typhoid contracted by employees from drinking water furnished by said corporations.

The importance of this decision and the possible tendencies are readily apparent and if, as has already happened, it is followed by other decisions of a similar character, the effect on railways and other corporations may be far-reaching. It is possible that employees and others ill from various obscure causes, may take advantage of these decisions thus causing more or less trouble and expense to railways by reason of claims, which in some cases may be made in good faith, yet be absolutely without foundation.

Attention is called to the fact that there are now nineteen States which have adopted the Railway Sanitary Code, viz.: Alabama, Florida, Georgia, Illinois, Kentucky, Kansas, Louisiana, Maine, Michigan, Mississippi Minnesota, Maryland, New Hampshire, Tennessee, Texas, Virginia, Wisconsin, Washington, District of Columbia, and West Virginia.

Appendix C—Specifications for Contracting Water Service Work

(*Condensed*)

SPECIFICATIONS FOR DUG WELLS

The well shall first be excavated placing cribbing as this work progresses. The cribbing plans shall be furnished by the Contractor and they must have the approval of the Chief Engineer.

The clear inside diameter of the cribbing should be sufficient to permit the well wall within. Where possible, the cribbing shall be salvaged as the wall work progresses.

The well wall shall be built upon a shoe whose cutting edge shall be level and the design for which shall have the approval of the Chief Engineer.

The outside diameter of the cutting shoe shall be a little larger than that of wall.

Care must be exercised in excavating so that the shoe is maintained in a horizontal plane.

The back surface of the wall should be made as smooth as possible and may be battered when directed by the Chief Engineer.

The wall shall be built tight except such portions that will be

opposite the water strata to be tapped where the wall shall be perforated to permit the infiltration of the water. The Chief Engineer will direct the location, size or amount of opening and the manner in which they shall be provided.

The top of the wall shall be finished level with anchor bolts placed as specified.

Ladder rungs of at least ⅝-in. round rods with bent ends shall be firmly built in the wall at 18-in. intervals from the bottom to the top of the well or other approved type of ladder and located as directed by the Chief Engineer.

The outside of the well wall above the grade line shall be finished as directed.

For excavation below the specified depths or for any additional excavation, the Contractor will be reimbursed on a cubic yardage basis at the unit price costs for the various classes of work specified in the contract.

All bailing up to 100 gal. per min. is included in the contract price but for bailing in excess of this amount, pumping for test purposes or any other extra work, the Contractor shall be paid actual cost plus the percentage specified in the contract.

The excavated material shall be placed and graded around the well or the excavated material shall be placed in one pile the location of which will be designated by the Chief Engineer. Or, the excavated material shall be placed in piles keeping the several classes of materials separate.

The well wall is to be of brick, concrete or stone. The brick or stone to be laid in 1 to 3 cement mortar.

The brick shall be good, hard, well-burned, free from cracks, of uniform size, shape and quality. Horizontal joints shall not exceed ⅜ in., they shall be laid well bonded with headers.

Brick Well Walls.—The brick shall be well laid and bonded and neatly struck on exposed surfaces. They shall be placed flat and radially with joints not to exceed ⅜ in., the vertical joints to be staggered.

The brick shall be thoroughly wetted (except in freezing weather) before laying.

Concrete Well Wall, Stone Well Wall, Well Roof.—(See A.R.E.A. Standard Specifications.)

There shall be a ventilator in the roof as designated by the Chief Engineer.

Specifications for Drilled Wells

Location.—(As designated).

Size and Depth.—(As designated).

Casing.—The well shall be cased with standard wrought pipe unless otherwise specified. Other pipe to be used only under special agreement between the Railway Company and Contractor.

The casing shall be placed in sections of varying sizes as follows:

Each section of casing shall overlap the adjoining section by 10 ft. as nearly as practicable, and, if in sand, shall be provided with a substantial lead packer properly driven in place or other approved method of sealing to prevent any leakage of sand into the well. If the bottom of the casing is seated in rock formation it must be driven tightly against the rock to insure against leakage of undesirable water, sand or mud into the well through the joint between the rock and casing, and a forged steel drive well shoe must be used on the casing to accomplish this purpose.

Well Screen (Strainer).—Where the supply is obtained from sand or gravel strata and not from sandstone, a well screen should be used in the bottom of the well, properly packed and connected to the bottom of the casing. The screen should be set by first driving the casing down to the depth at which the bottom end of the screen is desired, then placing the screen and pulling the casing back, allowing the casing to overlap the top end of the screen at least one foot, then driving the packer to place to secure sealing. While pulling the casing back the well tools must be set, resting on the bottom of the screen to prevent danger of screen pulling up with the casings.

The screen will ordered after the casing has penetrated the water bearing strata and it has been definitely ascertained as to length and gage of screen necessary. The screen, if used, shall be set in place by the Contractor without extra charge over the price bid on the work.

Test.—Whenever, in the judgment of the Chief Engineer of the Railway Company, the well may furnish a sufficient quantity of water, the Contractor shall, upon the request of the Carrier, furnish the necessary appliances for and make pumping tests of the capacity of the well. The appliances shall have a pumping capacity of not less than ..... gallons per minute, and the tests shall continue as long, and be repeated as often as, in the judgment of the Carrier's representative, is necessary. The depth of the well is to be determined by the result of such tests. The Carrier will pay the Contractor at the rate of ..... a day, or ..... per hour for the actual time occupied in preparing for and making the tests.

Material.—Where a screen is used the Carrier will furnish it, ordering same as soon as its proper length and gage has been determined.

General.—The Contractor shall, on completion of the well, remove all remaining material, rubbish, etc., incident to his work, and leave the well in a safe condition, securely plugging the top end of the casing and filling all excavations.

On completion of the work, the Contractor will furnish a complete and correct log of the well.

Shallow drilled wells for depots, section and bunk houses, and stock yards shall have concrete platform of an approved design 6 in. higher than the surrounding grade to prevent surface waters from flowing or seeping into the well. Each well shall be equipped with a hand or wind mill pump or other approved device.

Specifications for Pipe Lines and Fittings

Cast Iron.—These shall comply with American Water Works specifications as to dimensions, shape, weight, thickness and test, character of metal, finish and coating.

Grade Line.—This will be established by the Carrier's Engineers and must be accurately adhered to by the Contractor.

Excavation.—The depth of trench shall be below the frost line or at least ..... feet between ground surface and top of pipe. The bottom of the trench shall be even and true to the established grade and of sufficient width to permit proper caulking at joints.

Where necessary the trench should be shored to prevent caving and to protect the workmen. If trench is left open after working hours, some protection shall be installed, and after dark a red lantern shall be hung in a conspicuous place as additional protection.

If classified material is encountered the Contractor will receive additional compensation based upon the excess cost over that of earth plus the percentage specified in the contract.

Laying.—All pipe, fittings and castings shall be internally cleaned of all earth, rubbish and other objectionable matter before or at the time of laying.

All open ends shall be closed before stopping work.

Air relief and blowoff valves of approved make shall be placed where directed by the Chief Engineer or as indicated on the plans.

In laying the pipe the spigot shall be so adjusted in the bell or hub as to give a uniform space all around and if any pipe or fitting does not allow sufficient space for proper caulking is shall be replaced.

Caulking.—The caulking shall be faithfully executed and in such a manner as to secure a water tight joint without overstraining the pipe.

Gaskets of hemp, jute, yarn, etc., shall be braided or twisted and tightly driven before running or pouring the joint. Before pouring the lead the joint shall be clean and dry. The joint shall be run full in one pouring and the melting pot shall always be kept close to the joint poured.

Lead joints shall not be at any point or place less than $\frac{5}{16}$ inch in thickness nor less than 2½ in. deep.

No change of alinement of pipe shall be permitted after the joint is caulked.

The pipe line shall be water tight, 25 per cent over the working pressure.

Back Filling.—This shall be done as soon after the laying and testing as is consistent. The back fill from bottom of trench to top of pipe or fitting shall be first filled and well rammed or tamped. The material above the pipe can be loose filled and heaped to prevent depression, except at road crossings.

If for any reason the pipe or fitting is blocked up or if it does not securely rest on the bottom of the trench, the space under the pipe shall be carefully filled and well tamped.

At road crossings the back fill shall be placed in 6 to 8 inch layers and well tamped, and if necessary, puddled so that no depression will occur.

Wrought or Steel Pipe, Black and Galvanized

The pipe fittings, valves, etc., shall comply with the Carrier's specifications.

Grade Line.—Same as for cast iron pipe.

Excavation.—Same as for cast iron pipe except instead of "to permit proper caulking at joints" make it read "to permit proper tightening of the pipe joints and fittings."

Laying.—All pipe and fittings shall be internally clean before laid. All open ends shall be closed before stopping work. All threaded joints to be given a coat of ..... lead, plumbago, or other approved material before assembling.

Air relief and blowoff valves of approved make shall be placed where directed by the Chief Engineer or as indicated on the plans.

The pipe line shall be water tight at 25 per cent over the working pressure.

Back Fill.—Same as for cast iron pipe.

Wood Pipe.—Both solid and staved pipe and fittings shall comply with the Carrier's specifications. All sizes may come in unit lengths. Staved pipe may either be in unit lengths or in

staves to be built up in the field. The outside steel reinforcing for staved pipe may be either hooped or spirally wound.

The pipe and fittings should be laid according to the manufacturer's specifications.

SPECIFICATIONS FOR BUILDINGS

Buildings and Steel Tanks.—Shall be built according to the A.R.E.A. Specifications.

SPECIFICATIONS FOR WOODEN TANKS

Wooden Tanks.—(Snall conform to A.R.E.A. specifications).

Painting.—All timber and metal surfaces shall have one coat primer and two coats of finishing paint. Metal surface shall be steel brushed and cleaned before applying.

Inside of steel tanks shall have two coats of cement wash applied with a brush after the surface has been steel brushed and cleaned.

The wash to consist of 1½ parts of cement to one part of fine sand and mixed with water. The sand must pass through a 16-mesh screen. First coat to be dry before the second coat is applied.

Foundations.—Steel tanks resting directly on the foundation (i.e. without towers) shall have a level, smooth, even top surface of uniform supporting value to receive the tank, and may consist of a bed of crushed stone firmly tamped in 6 in. to 8 in. layers, or an even concrete slab.

Where towers are used, the spread of the footings under each post shall be proportional to the loading.

(Concrete, cement, sand, water, and timber shall conform to A.R.E.A. Specifications. For brick and paint, specification of A.S.T.M. may be used.)

Pipe.—Shall comply to the A.R.A. specifications.

Drain or Sewer Tile.—Shall be in conformity to the Carrier's specifications. The A.S.T.M. specifications may be used.

Tank Piping.—All piping shall have a swinging or expansion joint just before it enters the tank, to provide for adjustments in case there is any movement or settling of the tank. All joints to be water tight. There shall also be a valve of an approved type just outside the tank on each pipe line.

SPECIFICATIONS FOR WATER COLUMNS

These shall be of the Carrier's adopted or approved standard.

They shall be located from the center of the track in conformity to the clearance regulations of the State in which they are placed.

The height of spout shall be the Carrier's standard.

The pit shall be accurately staked out. The pit shall be shored until the walls are built. The materials and the manner of building shall conform to the A.R.E.A. specifications.

The floor of the pit shall pitch toward the drain.

Openings shall be made for the supply pipe, column pipe and manhole.

The roof may be either of concrete or timber, but strong enough to insure a good footing for the water column. The walls may be either concrete, brick, stone or creosoted timber, preference in the order given.

The water column shall be so placed that it locks with spout parallel to the adjacent track or tracks.

Appendix D—Pitting and Corrosion of Boiler Tubes and Sheets

Consideration is still being given to the possibility of reducing pitting and corrosion by eliminating the dissolved oxygen from the feed water. The opinion still prevails that oxygen plays an important part in pitting and corrosion, not as a primary cause but as a phase in the cycle consisting in the removal of ionic iron from the water in the boiler, thus disturbing the equilibrium and permitting further attacks on the boiler metals by any corrosive agent present in the water.

Efforts have been made to determine the difference of potential in various parts of the boiler. Readings obtained indicate that such differences exist, but the irregularity both in amount and location prevent our drawing any definite conclusions up to the present.

The Bureau of Standards is conducting elaborate tests of various classes of metals, these tests having special reference to rate of corrosion where metals are imbedded in soil. Although the conditions are somewhat different to those which the metal in a locomotive boiler is subjected to, there is a possibility that the results may have some bearing on the rate of corrosion of locomotive boilers.

Appendix E—Oil Engines in Railway Pumping Stations

The characteristic oil engine, or the one which uses petroleum oil for fuel, is now manufactured in three distinct types, which may be described as low pressure, medium and high pressure. The chief difference between these engines and those previously manufactured to operate on gas, gasoline or other light distillates capable of being handled through a carburetor is in the method of fuel injection.

The medium pressure oil engine, or so-called semi-diesel type, has now been brought to a state of perfection where it is generally the most economical and practicable type for all ordinary railroad water service installations. The pressures used in semi-diesel engines vary from 125 to 250 pounds.

The distillates of 26 deg. Baume and over are used to advantage in the semi-diesel crude oil burning engine which, by reason of the wide range of cheap fuel available, is rapidly becoming the standard for water station work. To avoid trouble oil engines should not be operated in excess of their rated hp. A properly designed engine of the so-called semi-diesel two-cycle type should operate on 0.6 lb. of fuel per brake hp. hour with a consumption of not over one gallon of cylinder lubricating oil per 400 rated hp. hour in the sizes of engines up to 25 hp. and one gallon per 800 hp. hour in the larger sizes.

Appendix H—Relative Merits of Materials for Pipe Lines

CONCLUSIONS

Cast iron pipe appears to be the most satisfactory pipe for underground water service under pratically all conditions, and its use is recommended for all installations where permanency and durability are desired.

Wood stave pipe is satisfactory for underground water service where operating and physical conditions are suitable, and with these conditions it may be recommended for use in case where the supplies are liable to be of a temporary nature or where, while not temporary in the usual sense of that term, there may be some doubt of absolute permanency. It may be recommended for use also under proper operating conditions for permanent supplies when its expectation of life may be high as in locations where alkali soil conditions tending to corrosion of the banding are known not to be present.

From standpoint of durability genuine wrought iron pipe is recommended for water lines above ground, for well casings and for all hot water, air and steam lines where cast iron pipe cannot be used.

It is recognized that other classes and kinds of pipe have been used successfully for certain services in the past and will continue to be used in the future, but as it is impractical to attempt to enumerate and describe the many different conditions under which pipe is used for each service the above recommendations are submitted as representing the best of current practice.

(The report of the Committee on Water Service was presented by the various chairmen of the sub-committees who outlined briefly the work which the sub-committees were doing.)

Discussion

A. F. Dorley (M. P.) chairman: Before the work on pitting and corrosion of boiler tubes and sheets can be completed, it will be necessary for the committee to secure the cooperation of the American Railway Association, as the Board of Direction decided some time ago, for the reason that the further along we get on this study the more we are impressed with the fact that the

matter of design and shop practice enters very largely into this question of corrosion and pitting.

C. H. Koyl (C. M. & St. P.): The term "water treatment" as understood by the sub-committee on the value of water treatment refers to water treatment for locomotives. It does not include water treatment for drinking purposes. The value of water treatment in any particular case depends upon the materials which are in the water, and which are taken out. Furthermore, in any particular case the value depends upon the amount of water that is used, upon the number of locomotives which take it, and other conditions. It is a long study to determine on different roads and in different parts of the country the amount of damage that is being done by water of certain grades, but we hope ultimately to be able to present definite conclusions and present the value of a water treating station in terms of the character of water, in grains per gallon, and designate certain materials which should be taken out, in terms of the amount of water used, and on the basis of the number of engines that use it, and everything reduced finally to a basis of ton miles traffic.

R. C. Bardwell (C. & O.): The data which we have given on standard methods of water analyses will enable the departments interested to determine the length of time it will take to form different degrees of thickness of scale in a locomotive boiler. The data which we provide for will enable the chemists in the field to determine roughly whether the water is being treated at all by roughly determining the amount of scale matter present. The sub-committee has not yet been able to make any definite agreement on some of these matters.

C. R. Knowles (I. C.): In preparing the report on the relative merits of cast iron, steel, wood and other materials for pipe lines the committee realized there were other classes and kinds of pipe used for certain services and will undoubtedly continue to be used in the future. But it is impossible to classify all the different kinds of pipe and service. The recommendation covers the best form of current practice and we can not show the comparative cost of these lines because the prices vary.

(The recommendations of the committee were approved and the committee dismissed with the thanks of the association.)

Report on Signs, Fences and Crossings

The enormous programs for highway construction in the United States and the increased importance of the highway grade crossing as a consequence of the marked increase in the number and speed of highway vehicles has had its influence on the work of the Committee on Signs, Fences and Crossings. This was reflected in the presentation of specifications for highway crossings, covering such matters as grade, width, drainage, flangeways, etc., not specifically covered in the usual state regulations. Another phase of this subject has been considered from the standpoint of the material of which the crossing is composed, a brief report being presented on substitutes for wooden crossing planks, indicating the results obtained with concrete and bitumen crossings. The committee also presented plans and specifications for round and square concrete posts with a view to obtaining an improvement of practice in the light of the more recent development in the technology of proportioning, mixing and placing of concrete. With the adoption of these specifications and rigid conformity therewith, considerable improvement should be obtained in the quality of posts produced. Maro Johnson has been chairman for two years, was previously vice-chairman for one year, and is now completing his ninth year on the committee.

Maro Johnson
Chairman

THE ACTION RECOMMENDED by the committee was as follows:

1. That the general specifications for highway grade crossings as given in Appendix A be approved for publication in the Manual.

2. That the matter in Appendix B relating to crossing materials be received as information.

3. That the specifications and plans for round and square concrete line fence posts as given in Appendix C be approved for publication in the Manual.

Committee: Maro Johnson (I. C.), chairman; T. E. Rust (W. C. F. & N.), vice-chairman; Anton Anderson (C. I. & L.), Arthur Anderson (N. Y. C.), F. D. Batchellor (B. & O.), G. F. Blackie (N. C. & St. L.), A. Crumpton (C. N. R.), L. B. Curtiss (N. P.), A. Daniels (C. M. & S. P.), G. N. Edmondson (N. Y. C.), A. B. Griggs (A. T. & S. F.), R. A. Harry (C. N. S. & M.), E. T. Johnston (Erie), S. C. Jump (I. C.), L. C. Lawton (A. T. & S. F.), O. H. Sessions (C. N. R.), S. E. Shoup (K. C. S.), W. C. Swartout (M. P.), A. H. Utter (C. B. & Q.), K. G. Williams (Union).

Appendix A—Specifications for Highway Grade Crossings

(Other Than Those for Which Requirements Are Stipulated by Law)

(1) A railroad grade crossing should be so constructed that it will not limit the traffic on a highway, in respect to the number of vehicles or load carried by the highway.

(2) The grade of the surface of the highway should be level with the top of the near rail for a distance of 1 ft. outside thereof; should be 3 in. lower 10 ft. outside of the rail; and should be not more than 3 in. higher nor 9 in. lower than the top of the rail at points 30 ft. from it, measured at right angles thereto. The grade beyond these 30 ft. points should not exceed that which prevails in the section of the country, for highways of the class under consideration.

This is illustrated in Fig. 1.

(3) When a highway crosses a railroad at an angle less than a right angle, consideration should be given to changing the alignment of the highway, so that the portion within the limits of the railroad right-of-way would be at right angles to the track.

This is illustrated in Fig. 2.

(4) The width of embankments at the crown, and of cuts exclusive of ditches, should be not less than 20 ft.

(5) Ample drainage for track and highway should be provided.

(6) A crossing should be constructed with continuous surface between points not less than 8 in. outside of each rail. The surface should be not more than ¼ in. below the top of the rail and should be beveled at each end. Flangeways 2¼ in. wide should be provided on straight track and on curves of 8 deg. and under, and 2½ in. wide on curves in excess of 8 deg. They should be flared at the ends to 3½ in. As far as it may be practicable to avoid them, there should be no rail joints within the limits of the crossing.

Appendix B—Substitutes for Wood Crossing Plank

Favorable reports have been received as to the service being given by concrete slab crossings installed on the Illinois Central at Champaign, Ill., in 1920 and by concrete

plank crossings at La Grange, Ill., on the Chicago, Burlington & Quincy in 1918. In general, bituminous crossings included in last year's report are giving satisfactory service, but some of those examined by members of the committee have been giving trouble around the rail joints and in a few instances wood plank have been installed adjacent to the rail. The trouble is believed to be due to improper track conditions at the time the crossings were installed, and emphasizes the necessity for putting the

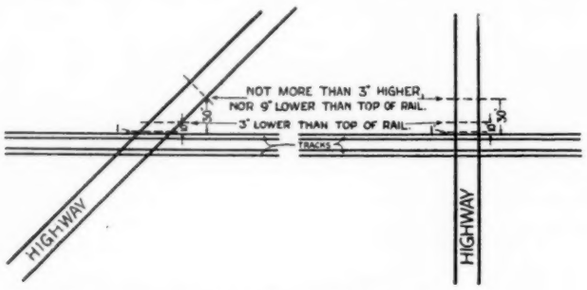


Fig. 1—Method of Fixing Approach Grades

track in first-class shape before laying the crossing materials. Advice has been received of the construction of 184 crossings of bituminous materials during the past year.

Appendix C—Plans and Specifications for Round and Square Concrete Fence Posts

This subject was assigned to the committee last year and tentative plans and specifications were submitted to the Association in March, 1922. Since that time these plans and specifications have been carefully studied and revised and they are now presented with the recommendation that they be adopted and printed in the Manual. Portions of these specifications which embody modifications from those presented last year, as published in the *Railway Age* of March 16, 1922, page 695, are as follows:

Specifications for Concrete Fence Posts

(I) MATERIALS

Intent.—1. The intent of these specifications and the plans of which they form a part is to produce concrete fence posts having a uniform and sufficient strength and durability at a minimum of cost. On account of the thinness of the section, this can only be accomplished by intelligent and constant attention to securing proper proportions of all the ingredients.

Cement.—2. Cement shall conform to the present Standard Specifications and Tests for Portland Cement of the A.R.E.A. and subsequent revisions thereof.

Fine Aggregate.—3. Fine aggregate shall consist of sand, stone screenings, or a combination thereof, having clean, hard, strong, durable, uncoated grains, and free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances. It shall range in size from fine to coarse, preferably within the following limits:

Passing through a No. 4 sieve, not less than 90 per cent. Passing through a No. 50 sieve, not more than 30 per cent. Weight removed by decantation, not more than 3 per cent.

Sand shall be tested for organic impurities as follows: Fill a 12 oz. graduated prescription bottle to the 4½ oz. mark with the fine aggregate to be tested. Add a 3 per cent solution of sodium hydroxide until the volume of the sand and solution, after shaking, amounts to 7 oz. Shake thoroughly and let stand for 24 hours. If the solution resulting from this treatment is darker than straw color the fine aggregate shall not be used unless the concrete made with the materials and in the proportions to be used in the manufacture of concrete posts is shown by test to be of the required strength.

Coarse Aggregate.—4. Coarse aggregate shall consist of crushed stone, gravel, or combinations thereof, having clean, hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter. It shall range in size from fine to coarse within the following limits:

For line posts: Passing a ½ in. screen, not less than 95 per cent. Passing a No. 4 screen, not more than 15 per cent. Passing a No. 8 screen, not more than 5 per cent.

For corner and end posts: Passing a ¾ in. screen, not less than 95 per cent. Passing a No. 4 screen, not more than 15 per cent. Passing a No. 8 screen, not more than 5 per cent.

Bank Gravel.—5. Natural combinations of fine and coarse aggregate, in the form of bank gravel, may be used, providing its particles meet all the requirements in Sections 3 and 4 above, including the colorimetric test, and provided such particles are properly graded from fine to coarse within the following limits:

Passing a ½ in. screen, not less than 95 per cent. Passing a No. 4 screen, from 40 per cent to 70 per cent. Passing a No. 50 screen, not more than 15 per cent. Weight removed by decantation, not more than 1½ per cent.

Water.—6. Water for concrete shall be clean and free from oil, or injurious amounts of acid, alkali, organic or other deleterious substance.

Metal Reinforcement.—7. Steel reinforcement shall be steel of hard grade and shall conform to the present Standard Specifications for Steel Reinforcement of the A.R.E.A. or, if wire is used, to the present Tentative Specifications for Cold-Drawn Steel Wire of the A.S.T.M., or to such modifications of either of such specifications as may hereafter be adopted by the A.R.E.A. Reinforcement shall be in the form of round or square bars, preferably deformed, or steel wires. Crimped, stranded or flat reinforcing shall not be used. Reinforcing, before being placed in the molds, shall be thoroughly cleaned of mill and rust scale, and of coatings that will destroy or reduce the bond.

(II) PROPORTIONING AND MIXING CONCRETE

Proportioning.—8. The unit of measure shall be the cubic foot. One bag of Portand cement shall be considered as one cubic foot. Each of the constituent materials shall be measured separately by volume, using a method which will secure the necessary proportions to product concrete of the specified strength. The water shall be measured by an automatic device that will secure the same quantity in successive batches.

Strength.—9. The proportions of cement, water and aggregate shall be such as to produce a concrete having a compressive

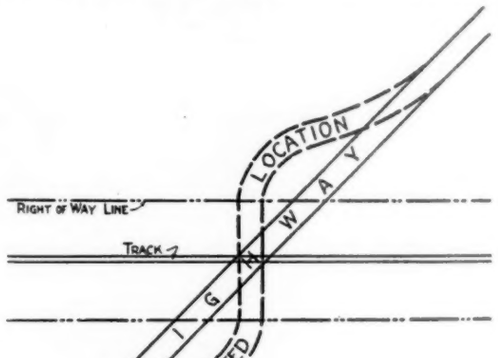


Fig. 2—Method of Relocating Highway Grade Crossings to Cross Tracks at Right Angles

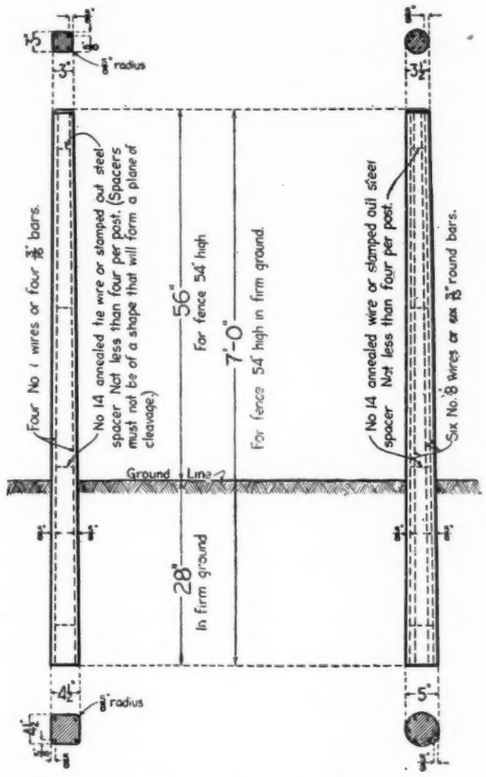
strength at 28 days of 2,500 lb. per sq. in. The proportions of fine and coarse aggregate to produce such a concrete shall be determined by making a screen analysis of the available aggregates and using such a mixture of cement, aggregate and water as will give a dense, workable concrete of the desired strength.

Consistency.—10. The quantity of water used in mixing shall be the least amount that will produce a plastic or workable mixture which can be properly compacted in the forms and around the reinforcement. Under no circumstances shall the consistency of the concrete be such as to permit a separation of the coarse aggregate from the mortar in handling. The consistency shall be measured by the slump test as follows:

The newly mixed concrete shall be placed in a truncated cone-shaped metal mold, 12 in. high, 8 in. in diameter at the base, and 4 in. in diameter at the top, and provided with handles at the sides. The concrete shall be lightly tamped with a rod as it is placed in the mold which, when filled, shall be immediately removed and the slump or settlement of the concrete noted.

The maximum slump shall not exceed 5 in. The consistency shall be checked at the beginning of each daily run and also whenever there is a change in the size or moisture content of any aggregate.

Mixing.—11. Mixing shall be done in a batch mixer of approved type, equipped with a suitable charging hopper, water storage, and water measuring device. The entire contents of the drum shall be discharged before recharging. Each batch shall


radius
Four No 4 wires or four ⅜" bars.
No 14 annealed tie wire or stamped out steel spacer Not less than four per post. (Spacers must not be of a shape that will form a plane of cleavage)
56"
For fence 54" high
7'-0"
For fence 54" high in firm ground.
No 14 annealed wire or stamped out steel spacer Not less than four per post.
Six No 8 wires or six ⅜" round bars.
Ground Line
28"
In firm ground
radius

Designs for Round and Square Concrete Fence Posts

be mixed for not less than 2 min. after all the materials are in the mixer, during which time the mixer shall rotate at a peripheral speed of about 200 ft. per min. The volume of the mixed batch shall not exceed the manufacturer's rated capacity. The retempering of concrete which has partially hardened shall not be permitted. In cold weather aggregate shall be heated, if necessary, to remove frost and frozen lumps.

Discussion

Maro Johnson (I. C.), chairman outlined the subjects referred to the committee after which *it was moved that Appendix A, specifications for highway crossings be adopted for publication in the Manual.*

J. B. Jenkins (B. & O.): Do these specifications carry with them the suggested method of relocating highway crossings in Fig. 2?

Chairman Johnson: It is intended that should go with the specifications, but as a suggestion only.

Mr. Jenkins: I would think that the suggestion should be revised by making a crossing immediately opposite one intersection of the road with the right of way line, thus avoiding one curve and a considerable central angle in the revised location. Furthermore, it is generally cheaper to deal with one property owner than with two.

Chairman Johnson: It seems to me in that case the radius of the curve on the approach side would be very short, would it not?

Mr. Jenkins: I think it is an advantage to have a short radius immediately at the crossing to slow down the automobiles and make them cross cautiously.

A. B. Griggs (A. T. & S. F.): The provisions as drawn in these specifications are sufficiently elastic to meet the objections on that question. It is not given here as an ironclad proposition.

Hunter McDonald (N. C. & St. L.): The tendency today is to cross highways with automobiles without stopping to look or listen at all and the smoother we make that approach the more we may expect the law of self-preservation to be violated. The principal problem is getting the concurrence of the road authorities to aid the railroad people in bringing about the provision of safety in these crossings, and it is a question of education of the public. They have got to be educated to take care of themselves. Where the authorities of the corporation or the town or the state highway are opposed, it would probably not be possible to go ahead and carry it out. But this Association should go on record as strengthening the arguments that might be put in order to get this enforced or changed so as to introduce these curves and in that way aid the men in bringing it about. It does not necessarily follow that because the Association recommends that method of shifting crossings that it is to be obligatory, but it is a condition that we should endeavor to bring about if we can.

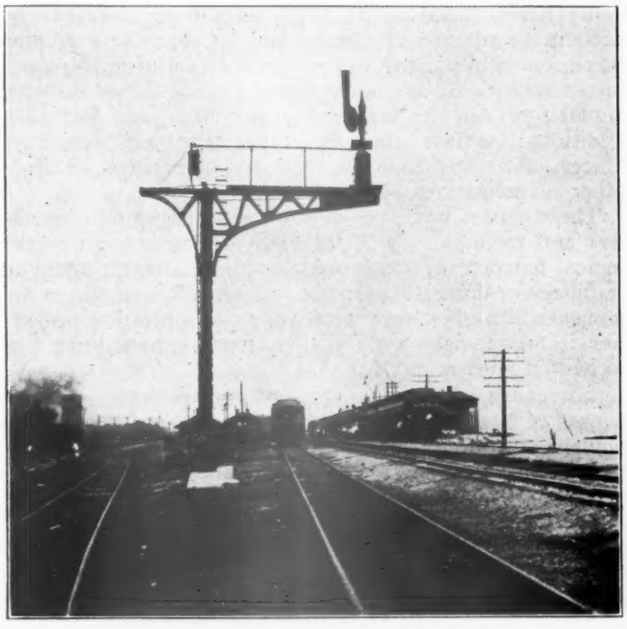
Mr. Jenkins: I think the discussion has become a little confused. My intent was that there should be a right angle crossing in all cases. My objection was simply to the four curves, where three curves would do just as well. I think the curves are necessary in doing away with the diagonal crossings in order to slow down the speed of the traffic over the crossing. One curve will slow down speed just as well as two curves, and in either case you will be running at right angles to the railroad. Three curves will do just as well as four.

Motion carried.

(The next subject was substitutes for wood crossings which was received as information, after which the report on plans and specifications for round and square concrete fence posts was presented. *It was moved that this report be approved for publication in the Manual. Motion carried.)*

(The committee was then dismissed with the thanks of the Association.)

* * *



On the Santa Fe at Shopton, Iowa

Signal Section which met at Drake Hotel yesterday

Signal Section Holds First Annual March Meeting

Session at the Drake Hotel Yesterday Marks Change in Location and Number of Meetings

THE SIGNAL SECTION of the A. R. A. opened the first day's session of its fifth annual meeting at the Drake hotel at 10 o'clock yesterday morning. This meeting is the twenty-eighth annual convention of the Signal Association and marks the first annual meeting to be held in March under the changed program under which two meetings are held each year instead of three. Chairman C. A. Christofferson (N. P.) presided. The opening was marked by a large attendance. During the afternoon session, C. A. McCune, sales engineer, Page Steel & Wire Company, read a paper on the manufacture and properties of commercially pure iron signal bond wire. The paper was illustrated by lantern slides showing cross sections of ingots. It was explained that the fatigue life of the bond wires was much longer when the percentage of slag was small.

The Chairman's Address

This section of the American Railway Association was badly handicapped in its activities during the year on account of adverse conditions and because the personnel was pressed into many and varied duties during the shopmen's strike. These unexpected outside duties reduced signal forces in the field and in the office, and laid such additional burdens upon the supervisory and executive officers that little time was left for committee work or other investigations.

These causes were, perhaps, an aftermath of the world war and we may as well leniently catalogue them as the logical outcome of some predetermined attempt again to stabilize our domestic existence. Regardless of the cause, however, the effect was felt by our transportation properties, in a financial way, and these extra expenditures had to be met with economy.

Because of existing post-war conditions, the expenses of our section followed in the wake of the general tendencies and crept up to alarmingly high totals. Then, in line with the general order, regulating all business expenses downward, the section was forced to face the issue by a serious consideration of both economy and efficiency.

The Sectional committee meetings brought out many good ideas in connection with maintenance and operation and this work reached men in the field by personal contact who do not attend the stated and annual meetings, yet, in the interest of economy, the Committee of Direction eliminated these sessions during the last year with a saving of $8,000.

In the interest of efficiency, and also economy, the committees have been reorganized and reduced from 20 standing committees to 12 and one or two special committees. These changes are shown in the pamphlet entitled "Rules and Regulations for Committee Work." Additional revisions by the Committee on Committees will further clarify and facilitate the work of these groups. In the old arrangement, the jurisdiction of some of the committees overlapped, so the reorganization has been made with the idea of preventing duplicated work and investigations. Incidentally, these reductions in the number of active committees will reduce our expenses approximately $3,600 per year. By reducing the signal meetings to two a year (one annual and one stated), these running expenses will be further reduced by approximately $2,400 for next year. These three changes in fundamentals, as above outlined, will make a probable total saving of $14,000 a year and will not materially cripple the activities of the section. This saving was not only necessary for the present, but it will be a good business policy for the future.

The changing of the annual meeting from June to March may seemingly upset past plans. There are, however, four good reasons for the change in date and location:

(1) The annual meeting will be held in Chicago each year in March. More members will be present because of the National Railway Appliances Exhibit, which will run at the same time in the Coliseum. This date and location will offer an opportunity for the signal engineer to meet the members of the American Railway Engineering Association, who also hold their annual meeting in Chicago, during the same week. It is among the possibilities that other sections of the A. R. A. will eventually follow our example and thus further concentrate the efforts by which we all hope to obtain results and which, in the end depend greatly upon sectional co-operation.

(2) It is necessary that our section of the A. R. A. have its annual report presented, sent out with letter ballot, votes returned and the report entirely completed for presentation to the parent body at the annual meeting of the American Railway Association, which is held in November. Past experience has proved that there was not sufficient time for our secretary to get this data into shape, without sending the letter ballots to the members in advance of the report covering the Proceedings of our annual meeting. Invariably corrections are made in the advance notice, after the discussions at the annual meeting. This gives the member an unsatisfactory conception of the subject on which he is about to vote. The past arrangement has met with many objections, but the *additional time* (between March and June) will give the regular and proper method of procedure sufficient time to function.

(3) By having the annual meeting in March and the stated meeting early in November, the committees will have more time to get their reports properly compiled and into the hands of the secreatry for discussion at the November meeting.

(4) There is economy involved in these changes for all concerned.

Much new and important work will demand our attention in the immediate future. Our past efforts have produced a Manual which is unexcelled by the recorded opinions of any body of engineers, but in compiling this data many of the bigger and broader responsibilities of the signal engineer were sacrificed to secure these details. With the present tabulated basic information, the Signal section now faces a golden opportunity to develop and then show its knowledge of operating problems to the managing officers. In conclusion, I wish to say that the year has been a profitable one for the section. Much has been accomplished regardless of interference from outside sources. These details will be shown in the report of our secretary.

C. A. Christofferson
Chairman

Report of the Committee of Direction

Among the subjects covered by the Committee of Direction was one reporting that E. H. Fritch, in a letter addressed to J. L. Campbell, chairman, Division IV, A.R.A., October 4, 1922, stated that a letter ballot submitted to the meeting of the General Committee on September 25, 1922, showed that the Signal section is duplicating some of the work of the Construction and Maintenance section, specifically that in connection with highway crossing signs. Mr. Campbell called this to the attention of J. E. Fairbanks, general secretary of the American Railway Association on October 12, suggesting that the attention of the chairman of the Signal section be called to this and that this section be instructed to confer with the Committee on Signs, Fences and Crossings of the Construction and Maintenance section so that an agreement could be reached before any new standard is adopted or any recommended standards changed. This matter was referred to the Signal section members who are on the General Committee of Division IV.

The Committee of Direction recommended that the subject, "The Operation of Trains on Single and Multiple Track Railways by Means of Signals," be recommended for discussion at the International Railway Association session to be held the second half-year of 1925. It is suggested that this describe methods used and economies effected by the use of signals and the relation of automatic train control to signaling. This was suggested by J. E. Fairbanks, general secretary, on August 30, 1922.

Under date of October 17, E. B. Katte asked the Signal section if it would be interested in appointing representatives on a joint committee on Electric Traction of the American Railway Association and was advised that the section would be interested in this matter. I. S. Raymer, in connection with the work on the Committee on Oils, is representing the Signal section on the Technical Committee on Lubricants and Liquid Fuels of the Bureau of Mines, and has become a member of Committee D-2 of the American Society of Testing Materials.

The Signal section meetings have been changed to two a year, an annual and a stated meeting, and an amendment is to be made to the Regulations covering this subject. The standing committees have been reduced from 20 to 13, consisting of 12 standing and one special committee. Suggested changes in rules and regulations as to letter ballot and other matters were considered by the Committee of Direction. The Committee also stated that the pamphlets on Robinson's "Invention of the Track Circuit" will be issued at $1.50 per copy.

There was a question as to whether the Signal section standard drawings 1425 and 1426 covering the standard plunger switch lock and details of its construction were an infringement of T. George Stiles' patent. The Eastern Railroad Association decided that it was not an infringement and this viewpoint was practically coincided in by the Western Railroad Association.

Secretary's Report

H. S. Balliet, secretary, in his report stated that a total of 87 members were enrolled during the year and 9 were reinstated, while there was a loss from various causes of 88. The distribution consisted of 1,023 representative members and representatives of members, 293 railroad affiliated members and 317 affiliated members, making a total membership of 1,633. The losses were as follows; Deaths, 4; lapsed, 40; resignation, 38; unable to locate, 6. The membership classification follows:

Summary of Membership
(As of March, 1923)

Assistant Terminal Managers	1
Chief Signal Engineers	1
Assistant Chief Signal Engineers	1
Chief Engineers	37
Assistant Chief Engineers	1

Signal Engineers	78	Assistant Superintendents Telegraph and Signals	2
Assistant Signal Engineers	39	General Superintendents	4
Signal-Electrical Engineers	1	Signal Superintendents	4
Signal-Electrical Superintendents	1	Superintendents	24
Principal Assistant Engineers	5	Supervisors Telegraph and Signals	49
Engineers	5	Assistant Supervisors Telegraph and Signals	19
Assistant Engineers	28	Signal Supervisors	332
Engineers, Maintenance of Way	14	Assistant Signal Supervisors	130
Division Engineers	13	Chief Signal Draftsmen	3
Chief Signal Inspectors	6	Chief Draftsmen	17
Signal Inspectors	76	Maintainers	70
General Signal Inspectors	19	Foremen	57
Inspectors	15	Miscellaneous	253
Superintendents Telegraph and Signals	11	Affiliated Members	317

Report on Maintenance Rules and Instructions

Rules for the guidance of levermen at interlocking plants are perhaps as varied as the number of roads in the country. Considering the delays often encountered at interlocking plants and even collisions and derailments resulting from a lack of proper instructions to the towermen, it may be considered as of paramount importance that a standard set of rules for the government of such employees should be established. New towermen not acquainted with the layout of an interlocking plant or the traffic to be handled, are especially liable to become confused at the first unusual occurrence. For example, if a route is lined up for an approaching train and it becomes necessary to change the line-up to use a conflicting route, the time release must be manipulated properly in order to secure a protection and at the same time cause the least possible delay. This report in reality involves the efficiency of train operation as it is affected by the proper operation of an interlocking plant. Such a set of rules was presented by this committee. It is to be expected that these rules may form a basis for directions to be issued by many roads for the government of their towermen. G. K. Thomas, assistant signal engineer of the Atchison, Topeka & Santa Fe is completing his third year as the chairman of this committee.

G. K. Thomas
Chairman

THE COMMITTEE PRESENTED for discussion a set of instructions for the guidance of signalmen (levermen) in the handling of interlocking plants as follows:

Instructions to Signalmen Concerning the Handling Of Interlocking Plants

1. Signalmen must not permit unauthorized persons to enter the interlocking station.

2. Levers, or other operating appliances, must be used only by those charged with that duty and as directed by the rules.

3. Signalmen will be held responsible for the care of the interlocking station, lamps and supplies; and, unless otherwise provided, of the interlocking plant.

4. Lights in interlocking stations must be so placed that they cannot be seen from approaching trains.

5. Lights must be used upon all interlocking signals from sunset to sunrise and whenever the signal indications cannot be clearly seen without them.

6. Signalmen must not make nor permit any unauthorized repairs, alterations or additions to the plant.

7. Inflammable material must not be stored in or around interlocking stations except in buildings or apartments provided for that purpose.

8. Interlocking stations must be kept in a clean and sanitary condition.

9. Signalmen must see that emergency tools as provided are kept in place for immediate use.

10. Signalmen must have the proper appliances for hand signaling ready for immediate use. Hand signals must not be used when the proper indication can be displayed by the interlocking signals and they must be given in such a way that there can be no misunderstanding by enginemen or trainment as to the signals, or as to the train or engine for which they are given.

11. Signalmen coming on duty will obtain from signalmen they relieve, exact information as to the condition of and all instructions or train movements affected or controlled by the plant.

12. Before using an emergency device to release electric locks, it must be ascertained that the signals are in the normal position.

13. When necessary to break a seal to gain access to any apparatus, immediate telegraphic report must be made to .....

14. Signalmen must report to ..... specific cases of enginemen permitting sand to be dropped or ash pans dumped within interlocking limits.

15. If necessary to discontinue the use of any interlocking signal, hand signals must be used and ..... notified.

16. The normal indication of home signals—stop; of distant signals—caution.

17. Levers must be operated carefully and with a uniform movement. If any irregularity indicating a disarrangement of the connections is detected in their working, the signals must be restored so as to display their most restrictive indication and the connections examined.

18. Signalmen must be sure that the latches travel full stroke so that other levers in the route will be released.

19. Stepping on the rockers to operate latches is damaging to apparatus, and handles provided for that purpose must be used.

20. Levers of power interlocking machines are equipped with indicating devices to check the normal position of signals and the normal and reverse position of other functions. Should the indication fail and continue to fail after two or three operations of the lever the *indication must not be picked*, but the function should be examined to see that it is in the required position, and if the function is a switch, derail or movable point frog, it must be spiked before a train or engine is permitted to pass over it. Should it be discovered that a lever can be operated without receiving the indication, similar action must be taken and ..... notified.

21. Where ammeters are used, the signalmen should watch them when operating levers, and when one shows current flowing longer than usual or that an excessive amount is being used, the lever should be restored to its original position and then operated again. If after two or three such operations, the movement is not normal, the lever should be put in a position so that the ammeter will show no current flowing and the function examined. A disarranged connection or obstruction may be found. If the ammeter shows no current flowing when the lever is operated and continues to show none after two or three operations, the fuse should be examined and renewed if necessary, using nothing but fuses provided by the signal department. If after renewing the fuse,

the ammeter shows no current flowing when the lever is operated, ... must be notified.

22. Should it be necessary to operate a motor driven switch, derail or movable point frog by hand, the motor brushes must be lifted before an attempt is made to operate the movement. When the function is in the desired position and it has been ascertained that the lever is in a corresponding position, the function must be spiked before a train or engine is permitted to pass over it.

23. A record of all failures should be kept for the information of maintainers.

24. When the route is set the signals must be operated sufficiently in advance of approaching trains to avoid delay.

25. Signals must be restored so as to display their most restrictive indication as soon as the train or engine for which they were cleared has passed.

26. If necessary to change any route for which the signals have been cleared for an approaching train or engine, switches or derails must not be changed or signals cleared for any conflicting route until the train or engine, for which the signals were first cleared has stopped.

27. When any portion of a train or an engine is standing on, or closely approaching a switch, derail, movable point frog, detector bar or circuit, the levers operating same should not be moved.

28. If a signal fails to operate properly, its operation must be discontinued and the signal secured so as to display its most restrictive indication until repaired.

29. Signalmen must observe, as far as practicable, whether the indications of the signal correspond with the positions of the levers.

30. If the electric lock on a lever fails to function, the signalman must not disconnect or otherwise operate it unless he is sure that the signals are in the normal position, and ..... is notified to have trains and engines regard the signals as out of order until repairs are made.

31. If the locking of an interlocking machine becomes disarranged or broken, signals affected must be set to display their most restrictive indication; switches, etc., in the route affected must be secure until repairs are made. In all such cases, ... must be notified promptly.

32. During cold weather the levers must be moved as often as may be necessary to keep connections from freezing.

33. During storms or while snow or sand is drifting, special care must be used in operating switches. If the force whose duty it is to keep the switches clear is not on hand promptly when required, the fact must be reported to .....

34. If a train or engine overruns a stop-signal, the fact must be reported to .....

35. If there is a derailment or if a switch, derail or movable point frog is run through, or if any damage occurs to the track or interlocking plant, the signals must be restored so as to display their most restrictive indication, and no train or switching movement permitted until all parts of the interlocking plant and track liable to consequent injury have been examined and are known to be in a safe condition.

36. When reporting damage to the interlocking, an explanation of the parts damaged should be given, as nearly as possible, so men may come prepared to make repairs and avoid unnecessary delays.

37. When switches, derails, movable point frogs or signals are undergoing repairs, signals must not be displayed for any movements which may be affected by such repairs, until it has been ascertained from the repairmen that the switches, etc., are properly set for such movements.

38. If necessary to disconnect a switch, derail, movable point frog, facing point lock, detector bar or its equivalent, all switches, derails and movable point frogs affected must be secured for safe train operation and ..... notified.

39. When a switch or movable point frog is disconnected, it must be securely spiked with spikes, placed in the first and second ties back of the point in the closed side.

40. When a derail is disconnected, it must be securely spiked or fastened in the required position.

41. If necessary to spike one end of a crossover, the other end must be spiked in the corresponding position.

42. If necessary to disconnect a pipe connected device, this should be done at the crank nearest the device.

43. The operating lever of a device temporarily inoperative must be blocked, and, or marked so that it is easily distinguishable.

44. If it is necessary to disconnect a lock on a traffic lever, the signalman will not display a clear signal, but movements over the track, or tracks affected, may be made with permissive signal.

45. Signalmen must observe all passing trains and note whether they are complete and in order; should there be any indication of conditions endangering the train, or any other train, the signalmen must take such measures for the protection of trains as may be practicable.

46. If a signalman has information that an approaching train has parted, he must, if possible, stop trains or engines on conflicting routes, clear the route for the parted train, and give the train-parted signal to the engineman.

Committee: G. K. Thomas (A. T. & S. F.), chairman; Caleb Drake (C. & N. W.), vice-chairman; A. Valee (D. & H.), vice-chairman; C. M. Duffy (C. R. I. & P.), H. J. Foale (Wabash), O. Falkenstein (T. & O. C.), F. C. Foster (L. & N.), T. G. Inwood (N. Y. C.), J. A. Johnson (M. K. & T.), Arthur Kelly (C. C. C. & St. L.), F. A. Selke (C. I. & L.), A. W. Stewart (A. C. L.), F. A. Tegeler (C. B. & Q.), I. A. Uhr (St. L.-S. F.), E. Winans (A. T. & S. F.).

Discussion

G. K. Thomas (A. T. & S. F.), chairman: In preparing these instructions the committee has copied verbatim all of the rules for signalmen. Mr. Elsworth suggested a change in section 11 which is a good one. In line with the suggestion the committee has prepared a rule, instead of 11, reading as follows: "Signalmen coming on duty will obtain from the signalmen relieved, and the latter will give to the former, exact information as to the condition of the plant and train movements affected or controlled thereby."

In section 28 the word "operate" should be "work" in order to comply exactly with the wording of code rule 620.

The committee wishes to change section 39 to read "when a switch or movable point frog is disconnected it must be secured with spikes placed at the first and second ties back of the point at the closed side."

T. S. Stevens (A. T. & S. F.): The committee has used properly the term signalmen in accordance with the code, but probably the time has come when we might make some recommendations along these lines to the American Railway Association, operating division. We have about come to the time when the term signalmen is definitely applied to the maintenance force and we can't get away with it, apparently. I think towermen is the right term to use.

A. H. Rudd (Penna.): I agree with Mr. Stevens. It is going to be an uphill job, because the operating rules provide for signalmen. The standard code is being revised now, I believe.

H. S. Balliet (N. Y. C.): In line with Mr. Rudd's discussion a committee has been hired from the Operating division for revising the standard code. They have been working on it about six weeks. It would be opportune to originate a resolution to the main body suggesting consideration of this very important point, and it certainly will be given immediate consideration.

Mr. Stevens: *I move that the Signal section recommend to the Operating division that the term signalmen be confined to maintenance forces. (Motion carried.)*

W. M. Post (Penna.): I notice about half the instructions are code rules. Is it that intention to recommend those rules which are not code rules to the Operating division? It occurs to me that this is an operating question, but we have the right, I assume, to suggest to the A. R. A. anything we want. Possibly these rules should be included in the new code.

Mr. Rudd: These are not rules, they are instructions. That line will be drawn next year and it seems to me the best thing is for us to refer this in part to the Operating division, as information, probably leaving out the operating rules entirely.

F. P. Patenall (B. & O.): There is only one way in which you can get all the good out of the rules and that is to take all of the rules that are written and throw out those which are no good and put those that apply in the proper place. You will then have a book of rules.

R. B. Elsworth (N. Y. C.): The standard code is in very good position with the backing of the dictionaries, in calling the men that operate the signals, "signalmen," and while under the Railroad Administration we were under obligation to a certain extent to call our maintainers signalmen, I think that that time has gone and that the Operating committee will do very well to give the matter serious consideration before they go along with this section and reserve the title of signalmen exclusively to the men who construct and maintain signals.

It was moved that this report be accepted as information. (Motion carried.)

Report of Committee on A. C. Signaling

The efficient and economical operation of a. c. track circuits constitutes one of the most difficult problems of an a. c. signal installation, therefore the report of this committee devoted to the subject of track circuits is especially valuable to those men in the field who are responsible for track circuit maintenance. The committee presented a form on which data and information should be furnished for determining track circuit adjustment, rail impedance and ballast resistance. On troublesome track circuits this information can be forwarded to the head of the department or to the manufacturers for scientific investigation by the designing engineer, who may be in a position to offer recommendations to correct the trouble. A list of precautions to be observed in taking readings on rail impedance and ballast resistance was followed by a complete explanation of the phase angle method of solving track circuit problems. Circuits and vector diagrams were given in the illustrations. The report closed with a full set of instructions for the adjustment, care and operation of a. c. track circuits. The entire report is intended for the practical use of maintainers and inspectors who have occasion to adjust a.c. track circuits. C. H. Morrison, signal engineer of the N. Y. N. H. & H., has been chairman of this committee for nine years.

C. H. Morrison
Chairman

THE COMMITTEE PRESENTED forms for recording the characteristics of a.c. track circuits, together with sketches and directions for making field readings and adjustments of track circuits. The committee recommended that this report be accepted for submission to letter ballot.

Precautions to Be Observed in Taking Readings in the Field for Rail Impedance and Ballast Resistance

1. The condition of the insulated joints should be tested to insure that there is no leakage through them. This can be most easily done by shunting the track circuit on the other side of the joints and noting that this causes no change in the reading of the ammeter in the transformer leads.

2. The condition of the bonding should be tested by taking voltage readings across the track every 15 rail lengths, or as required by special length track circuits, with the track circuit in its normal operating condition. Poor bonding or ballast will be indicated by unusual voltage drops between the successive readings. It should be noted if there are any poor sections of ballast or bonding in the track circuit which would make the distribution of the leakage non-uniform and also give erratic voltage readings.

If an unusual voltage drop is found between successive readings, take readings across the rails every rail length, at the same time inspecting the individual bond wires in this particular section, which steps will usually enable the defective bond to be detected.

3. The sets of readings, first with the relay disconnected and second with the track short circuited, should be taken, if possible, without an intervening train movement through the track circuit which might change the conditions of bonding or insulated joints.

4. The jumper indicated in Fig. 1, for short circuiting the track at the relay end, should not have a higher resistance than 5 ft. of No. 9 copper wire and it can best be connected to the rails by the use of the low resistance test clamp.

5. The resistance of the volmeter should not be less than 20 ohms per volt.

6. The non-inductive resistor in series with the transformer leads for measuring phase angle of current should give a voltage drop of about 0.5 volt for the current flowing. This will generally require a resistance of from 0.1 to 0.2 ohm and can be easily obtained by using from one to two feet of No. 18 A. W. G. 18 per cent German silver resistance wire.

7. In case it is desired to measure the rail impedance and ballast resistance of double rail electric road track circuits by this method, it will be necessary to disconnect the impedance bonds before taking readings.

Formula for A.C. Track Circuits—Phase-angle Method

Observed readings (see Figs. 1 and 2).

E_o=volts across rails opposite transformer, track open circuited.

E_s=volts across rails opposite transformer, track short circuited opposite track relay.

I_o=amperes to track from transformer, track open circuited.

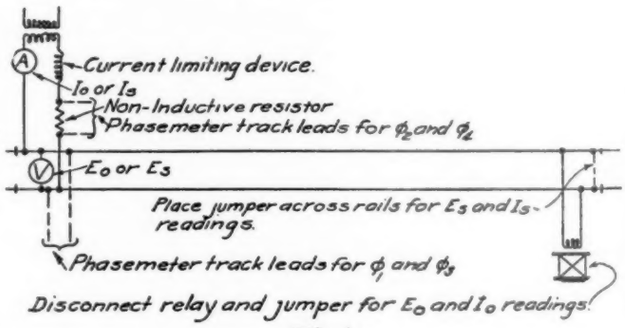
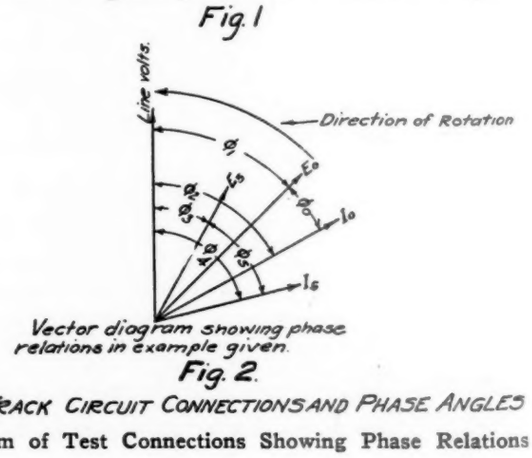

A
Current limiting device.
Io or Is
Non-Inductive resistor
Phasemeter track leads for ϕ2 and ϕ4
Eo or Es
Place jumper across rails for Es and Is readings.
Phasemeter track leads for ϕ1 and ϕ3
Disconnect relay and jumper for Eo and Io readings.

Fig. 1



Vector diagram showing phase relations in example given.

Fig. 2.

TRACK CIRCUIT CONNECTIONS AND PHASE ANGLES

Diagram of Test Connections Showing Phase Relations

I_s=amperes to track from transformer, track short circuited opposite track relay.

Φ_1=angle between E_o and line volts.
Φ_2=angle between I_o and line volts.
Φ_3=angle between E_s and line volts.
Φ_4=angle between I_s and line volts.

If any of these angles lead line volts, they should be given a plus sign to distinguish from lagging angles, which will usually be obtained, and which are given a minus sign.

Calculated values:

$Z_o = \frac{E_o}{I_o}$ = impedance of track circuit on open circuit.

$Z_s = \frac{E_s}{I_s}$ = impedance of track circuit with short circuit opposite track relay.

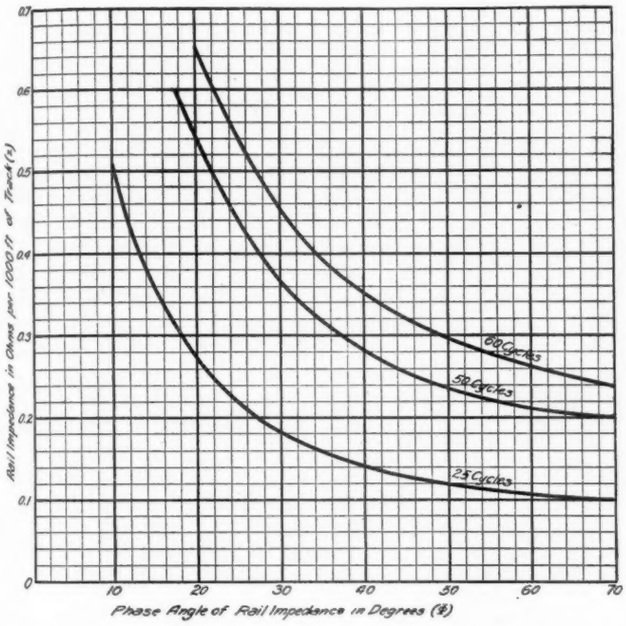


Fig. 3—Curve Relation of Rail Impedence and Phase Angle

$\Phi_o = \Phi_2 - \Phi_1$ = phase angle of Z_o.
$\Phi_s = \Phi_4 - \Phi_3$ = phase angle of Z_s.

Then

$\Phi_z = \Phi_o + \Phi_s$ = phase angle of rail impedance.

z=rail impedance per 1000 ft. of track and can be obtained directly from curve chart Fig. 3 by taking value corresponding to Φ_z.

$r = \frac{Z_o \times Z_s}{z}$ = ballast resistance per 1000 ft. of track.

Example for a 5,000 ft. A. C. Track Circuit.—Track Circuit Frequency 60 Cycles

Observed readings:

E_o = 4.35 volts, I_o = 3.2 amp., Φ_1 = —45° and Φ_2 = —58°.
E_s = 3.4 volts, I_s = 3.1 amp., Φ_3 = —30° and Φ_4 = —67°.

From these values

$Z_o = \frac{E_o}{I_o} = \frac{4.35}{3.2} = 1.36.$

$Z_s = \frac{E_s}{I_s} = \frac{3.4}{3.1} = 1.1.$

$\Phi_o = \Phi_2 - \Phi_1 = -58° - (-45°) = -58° + 45° = -13°$

and

$\Phi_s = \Phi_4 - \Phi_3 = -67° - (-30°) = -67° + 30° = -37°$

then

$\Phi_z = \Phi_o + \Phi_s = -13° + (-37°) = -13° - 37° = -50°$ phase angle of rail impedance.

and

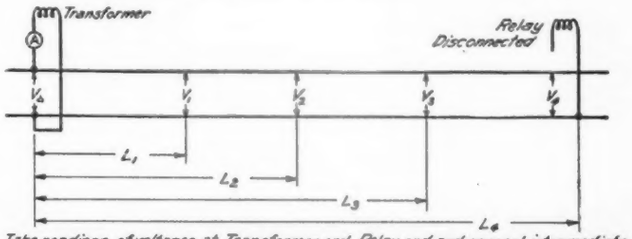
z=0.3 ohms per 1000 ft. at 50° (0.64 P. F.) rail impedance. (See Curve, Fig. 3.)

$r = \frac{Z_o \times Z_s}{z} = \frac{1.36 \times 1.1}{0.3} = \frac{1.5}{0.3} = 5$ ohms per 1000 ft. ballast resistance.

Example of Calculation of Ballast Resistance Using Ammeter and Voltmeter

(See Fig. 4.)

4000 ft. electric track circuit. Track circuit frequency 60 cycles. 100 lb. rail—rail impedance 0.25 ohm at 0.4 P. F. per 1000 ft. Ballast resistance 2.0 ohms per 1000 ft.



Take readings of voltages at Transformer end, Relay end and several intermediate point and plot against distances from Transformer end obtaining a curve similar to Fig. 5.

Fig. 4—Method of Calculating Ballast Resistance Using Ammeter and Voltmeter

Calculated readings using above constants with impedance bonds and relay disconnected.

A = 2.32 amp. } Phase angle between
V_s = 1.66 v. } V_s and A = —20°.

V_1 = 1.31 v. L_1 = 1000 ft.
V_2 = 1.12 v. L_2 = 2000 ft.
V_3 = 1.03 v. L_3 = 3000 ft.
V_4 = 1.00 v. L_4 = 4000 ft.

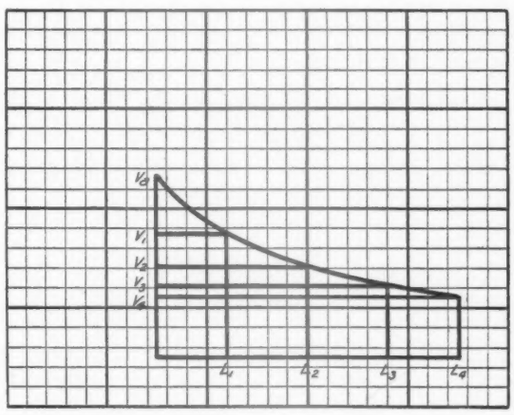
V_x = 1.189 Mean rail voltage.
$V_x \div A = 1.189 \div 2.32 = 0.513$ ohms total ballast resistance.
$0.513 \times 4 = 2.05$ ohms ballast resistance per 1000 ft.

Calculated readings with relay end of track circuit shorted.

E_s = 1.18 v. } Phase angle between
I_s = 1.67 amps. } E_s and I_s = —45°

$Z_s = \frac{1.18}{1.67} = 0.706$ at —45° $Z_o = \frac{V_s}{A} = \frac{1.66}{2.32} = 0.715$ at —20°

$Z_o \times Z_s = 0.505$ at —65°.



Obtain mean voltage V_x by dividing area between curve and base line by length of base line L_4.
The total ballast resistance $R = V_x \div A$.
R_x total length in 1000 Feet = Resistance in Ohms per 1000 Feet

Fig. 5—Curve for Obtaining Ballast Resistance

From curve z = 0.25 ohms per 1000 ft. for —65° phase angle (rail impedance).

$r = \frac{Z_o \times Z_s}{z} = \frac{0.505}{0.25} = 2.02$ ohms ballast resistance per 1000 ft.

Committee: C. H. Morrison (N. Y. N. H. & H.), chairman; L. F. Vieillard (L. I.), vice-chairman; B. T. Anderson (D. L. & W.), T. N. Charles (Sou.), G. H. Dryden (B. & O.), W. F. Follett

(N. Y., N. H. & H.), C. E. Goings (Penna.), A. A. Roberts (S. Brooklyn), J. M. Waldron (I. R. T.), F. E. Wass (N. Y. C.).

Discussion

C. H. Morrison (N. Y. N. H. & H.): Your committee submits for the consideration and for acceptance and submission to letter ballot as revised—A. C. Track Circuit Characteristics and Instructions for the Adjustment, Care and Operation of A. C. Track Circuits.

L. F. Vieillard (L. I.): It was suggested the head reading, "Formula for a. c. track circuits" was broad, so we added additional phraseology reading "Ballast resistance and rail impedance measurements." Attention was called to certain typoghaphical errors of the revisions and additions to the committee's instructions for the "Adjustment, Care and Operation of A. C. Track Circuits."

(A motion that the A. C. Track Circuit Characteristics be accepted for submission to letter ballot as revised, was carried.)

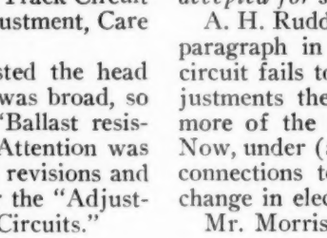
Mr. Morrison: *I move that Instructions for the Adjustment, Care and Operation of A. C. Track Circuits be accepted for submission to letter ballot as revised.*

A. H. Rudd (Penna.): We would like to ask regarding paragraph in general instructions, reading, "If a track circuit fails to operate, with transformer and reactor adjustments the same as on similar track circuits one or more of the following conditions may be responsible": Now, under (a) could not that be changed to read, "Loose connections to rails, relays, reactor, or transformer or change in electrical characteristic of the relay?"

Mr. Morrison: We accept that. *(Motion carried.)*

Report of Committee on Mechanical Interlocking

On account of the increasing popularity of the electro-mechanical interlocking plants, especially at small and medium sized plants, it is highly important that specifications for the locking in these machines be standardized in order to permit future additions to the plants with the least possible changes. The desirable characteristic for the electro-mechanical interlocking machine is that, in setting up the route the mechanical levers used for the derails and switches select the signals, so that a single electric lever may be used for several signals. When increasing the size of an existing plant it may be possible in many cases to add an electrical section to the existing mechanical machine, therefore no change in the tower building will be required. With these ideas in mind the committee has done well to standardize the connecting feature of the electrical and mechanical parts of the machine. C. J. Kelloway, signal engineer of the Atlantic Coast Line, has been chairman of the committee for the past 25 years, having held this office since the committee was organized with the exception of one year, 1920, during which he was chairman of the Signal division, A. R. A. It is through Mr. Kelloway's persistent effort that this important specification on electro-mechanical interlocking machine, I. S. & F. miniature locking, was produced.



C. J. Kelloway
Chairman

THE COMMITTEE SUBMITTED A.R.A. Signal section specification No. 12,523, for an Electro-mechanical Interlocking Machine, I. S. & F. Locking, with recommendation that the specification be accepted for submission to letter ballot.

Electromechanical Interlocking Machine—I. S. F. Miniature Locking

1. Requisite Section.—(a) Requisite section 12523 forms a part hereof.

(b) Where blanks have not been filled, or where an option has been permitted and no preference stated, the contractor's recommended practice shall be followed.

2. Tender.—(Standard Section).

3. Drawings.—(a) Purchaser's drawings forming an essential part of this specification are as shown in section 12523-R-a.

(b) Track and signal plan, circuit plans, combination wiring plan, locking sheet and dog chart, shall be approved by the purchaser.

1. The purchaser shall state his criticism or approval of any of these plans submitted by the contractor, within the number of days specified in section 12523-R-3-b-1 after their receipt.

2. No change shall be made in any approved drawing without the written consent of the purchaser.

4. General.—(a) Mechanical levers shall be spaced 5 in. center to center.

(b) Electric levers shall be spaced 2½ in. center to center.

(c) Levers shall be arranged so that they can be removed without interfering with other levers.

(d) Spare levers shall be furnished in place complete, ready for operation and control of their respective units.

(e) Adequate means shall be provided to prevent accidental operation of electric levers.

(f) Machine legs, bottom girders, lever shoes, mechanical lever quadrants, top plates, rocker links, bearings, end strips, counterweights, locking brackets, lever number plates for mechanical levers and frame for supporting electric levers, locking, electric locks, spring combination, terminal boards, and such other devices and equipment as may be connected directly with the electric levers, shall be made of cast iron.

(g) Latch shoes, link blocks, latch handles, latch nuts and bottom girder caps shall be made of malleable iron.

(h) Mechanical levers, tail levers, latch blocks, latch rods and connecting rod between electric levers and bolt locks, shall be made of open hearth steel.

(i) Locking shafts, longitudinal locking bars, cross locking dogs and stops, and pins, shall be made of cold drawn steel.

(j) Trunnions shall be made of forged steel.

(k) Latch springs for mechanical levers shall be made of spring steel wire.

(l) Mechanical lever portion of machine shall consist of four and eight lever sections.

(m) Height of mechanical lever portion of machine for vertical leadout shall be 2 ft. 8⅛ in. from bottom of leg to finished top of top plate.

(n) Height of mechanical lever portion of machine for horizontal leadout shall be 3 ft. 5⅞ in. from bottom of leg to finished top of top plate.

(o) Each spare mechanical lever space shall be equipped with cap and pin for lever shoe.

(p) Bolts and screws ¼ in. diameter and larger shall have U. S. Standard thread; screws less than ¼ in. diameter shall be A. S. M. E. Standard.

(q) Nuts, bolts and cap screw heads shall be hexagonal.

(r) Bolts and cap screws shall be provided with spring lock washers where practicable.

(s) Taper dowel pins shall be standard taper ¼ in. to the foot.

(t) When necessary to hold parts in fixed relation to each other, dowel pins or body-bound bolts shall be used.

(u) Moving parts of machine shall work freely, without lost motion.

(v) Machine shall be painted in accordance with A. R. A. Signal section specification 12022—Paint and Painting.

(w) All parts of machine shipped knocked-down shall be marked with steel figures on a finished surface and given the numbers they take in the assembled machine. Numbers shall be visible in the assembled machine where practicable.

(x) Locking brackets, cross locking, locking and swing dogs shall be marked to permit reading from front of machine. Longitudinal bars shall be marked on the ends with space number. Swing dogs shall be marked with lever number at the trunnion end and bracket number at nose end.

(y) Counterweights for mechanical levers shall be provided as shown in section 12523-R-4-y.

5. Design.—(a) Like parts of same manufacturer's machine shall be interchangeable.

(b) The machine frame and locking bed shall be so designed that additional sections may be added on either end.

6. Machine Legs.—(a) Legs for mechanical vertical leadout machine shall be 2 ft. 7¼ in. in height, and base of leg shall be provided with four holes for ¾ in. bolts.

(b) Legs for mechanical horizontal leadout machine shall be 3 ft. 5 in. in height, and base of leg shall be provided with four holes for ¾ in. bolts.

7. Upper Frame.—(a) Frame carrying electric levers, locking bed, electric locks, spring combination and terminal board, shall be supported on machine legs and attached thereto by ½ in. bolts and two No. 8 standard taper dowels.

8. Bottom Girders.—(a) Bottom girders shall be fastened to legs with two ¾ in. thin square head body-bound bolts.

(b) Caps shall be fastened to bottom girders with two ½ in. square head machine bolts.

9. Top Plates.—(a) Top plates shall be fastened to machine legs with six ½ in. T-head bolts; one ½ in. cap screw and four No. 8 taper dowel pins.

(b) End strips shall be fastened to top plates with two ½ in. T-head bolts.

10. Levers.—(a) Levers shall have equal and uniform throw and shall be true in alignment.

(b) Two-position levers shall be designed to latch in normal and reversed positions.

(c) Three-position levers shall be designed to latch in normal, intermediate and reversed positions.

(d) Electric levers shall be designed to permit the application of electric locks or mechanically operated time releases independently of indication locks.

(e) Spare electric levers specified in section 12523-R-10-e shall be furnished in place complete with standard circuit controllers, locking shaft and driver, and electric locks.

(f) Rod connecting bolt lock between electric and mechanical lever shall be provided with an adjusting screw and check nuts.

(g) Mechanical levers shall be 5 ft. 10⅛ in. from center of fulcrum to end of handle.

(h) Tail levers shall be drilled to provide 8¾ in. stroke and 9¾ in. stroke, and shall be interchangeable as front or back tail levers.

(i) Mechanical lever shoes for vertical leadout machines shall provide approximately equal stroke above and below horizontal, and be arranged so that connections can be made to front or back tail lever.

(j) Mechanical levers and tail levers for vertical leadout machine shall fit snugly into lever shoe and be fastened thereto with two ¾ in. body bound bolts.

(k) Mechanical levers for horizontal leadout machine shall be fastened to lever shoe with three ¾ in. body bound bolts.

(l) Mechanical lever shoe pins shall be 1 in. diameter. End pins shall be held in place by one ⅜ in. square head cupped point set screw through girder cap.

(m) Mechanical lever latch shoes shall be fastened to lever with two ½ in. tap bolts and one No. 8 taper dowel pin.

(n) Quadrants for mechanical levers shall be fastened to top plate with three ½ in. bolts.

(o) Rocker links shall be fastened to quadrants with one 1 in. diameter grooved pin; pin to be held in place in quadrant with one ⅜ in. by ⅝ in. cone point headless set screw.

(p) Latch rods for mechanical levers shall be ⅝ by 24¾ in. from end of block to end of thread, thread to be S. A. E. standard (18 threads to the inch), 2¼ in. long, and equipped with hexagon check nuts. Trunnion for latch blocks shall be equipped with one 1½ in. diameter cut washer and one 3/16 in. cotter pin.

(q) Latch nuts shall be straight, 3 in. long from center of hole to end of nut, and shall be tapped 2¼ in. deep with an S. A. E. standard (18 threads to the inch) ⅝ in. tap.

(r) Latch springs for mechanical levers shall be 11/16 in. inside diameter, and shall be of sufficient strength and range of compression to properly operate the lever latch.

(s) Latch handles for mechanical levers shall be 12 in. from center of holes to end of handle and shall be connected to lever and latch rod with two ½ in. round cheese-head pins.

(t) Number plates for mechanical levers shall be in accordance with drawing 1504, and be fastened to levers with one ½ in. round cheese-head pin.

(u) Link blocks shall be 1 in. by 1½ in. by 1⅛ in. with a sliding fit, to have lip 5/16 in. thick and not less than 5/16 in. high.

11. Locking.—(a) Machine shall be provided with miniature locking of the preliminary type.

(b) Locking shall be operated by electric levers.

(c) A bolt lock shall be provided between mechanical lever and its indicating electric lever to so operate that the latch of mechanical lever cannot be manipulated until electric lever is moved to midstroke. Bolt lock shall hold electric lever at midstroke until mechanical lever is latched in its normal or reverse position.

(d) Locking shall be distributed as uniformly as possible without crowding.

(e) Locking dogs, trunnions and stops shall be riveted to bars.

(f) Locking shaft complete with driver and longitudinal locking bar the full length of the machine shall be furnished for each lever.

(g) Locking brackets shall be furnished in place for each lever and spare brace.

(h) Locking brackets shall be filled with cross locking steel.

(i) For each spare space, provision shall be made for one locking shaft and one longitudinal locking bar the full length of the machine.

(j) Longitudinal locking bars secured in place shall be used in lieu of filler blocks.

12. Machine Case.—(a) Machine shall be enclosed in a steel case, which shall have separate removable doors or panels of convenient size to permit access to all parts of the machine, and shall be finished and provided with locks.

13. Dielectric Requirements.—(a) Electric apparatus assembled shall withstand for one minute an insulation test, at place of manufacture, of 3,000 volts a. c. between all parts of electric circuits and other metallic parts insulated therefrom.

(b) A surface leakage distance of not less than ¼ in. shall be provided between any exposed metallic part of the apparatus carrying current and any other metallic part thereof.

(c) Separate windings, which are insulated from each other, shall withstand for 1 min. an insulation test of 3,000 volts a. c. between their terminals.

(d) A potential of twice the normal operating requirements at a suitable frequency shall be impressed across the windings without any excessive flow of current indicating a short circuit.

14. Insulation.—(a) Coils and windings shall be of cotton or silk-covered wire, impregnated; of enameled wire, or as shown in R-14-a. Enameling or impregnation shall be in accordance with R. S. A. specifications.

(b) Material used for insulation shall be such as will not be injuriously affected by atmospheric conditions.

15. Circuit Controllers.—(a) Machine shall be equipped with manufacturer's standard circuit controllers necessary for the control of circuits shown on drawings listed in section 12523-R-3-a.

16. Auxiliary Circuit Controllers.—(a) A mechanical stick circuit controller actuated by a push button and having one normally open and one normally closed contact shall be provided for electric levers specified in section 12523-R-16-a. The stick on these controllers shall be interrupted by the lever after it has passed the indicating point going normal.

17. Indication.—(a) Levers used for electric indications, or for the control of switches, derails, movable frogs, or apparatus requiring equivalent protective circuits, shall be provided with a device to insure the locking of the units in a position corresponding to the position of the lever before the mechanical locking is released, also a device to prevent the movement of the lever from the full normal or reverse position when the protecting track circuit is occupied.

(b) Levers for the control of signals shall be equipped with devices to prevent the release of the mechanical locking until the signals directly or indirectly controlled have assumed their normal position.

(c) Indication locks shall be arranged to check the movement of levers at their indicating points, and lock plunger or latch shall be forced to locked position mechanically.

18. Detector Locking.—(a) Levers used for electric indication or the control of switches, derails, movable frogs, or apparatus requiring the equivalent in protective circuits, shall be provided with a normally open latch circuit controller for detector lock circuits.

(b) Electric detector locks shall be arranged to lock the electric levers within 14 degrees, as a maximum, of the normal and reverse positions and at midstroke. Lock plunger or latch shall be forced to the locked position mechanically for the normal and reverse positions.

19. Lever Light Indicators.—(a) Lever light indicators shall be provided as specified in section 12523-R-19-a.

(b) Lever light indicators shall be located in front of the machine immediately below the electric levers.

(c) Electric lamps for lever light indicators shall be as specified in section 12523-R-19-c.

20. Contacts.—(a) Contact springs shall be made of highly non-corrosive material of sufficient strength and current capacity to satisfactorily operate in connection with the circuits used.

21. Time Releases.—(a) Automatic time releases shall be provided as specified in section 12523-R-21-a.

22. Material and Workmanship.—(a) Material and workmanship shall be first-class in every respect.

(23. Inspection; 24, Tests; 25, Packing; 26, Marking, and 27, Warranty are standard sections.)

Committee: C. J. Kelloway (A. C. L.), chairman; W. N. Spangler (P. R. R.), vice-chairman; W. F. Zane (C. B. & Q.), vice-chairman; T. S. Adams (N. Y. C.), Larsen Brown (A. T. & S. F.), W. F. Cook (D. & H.), Oswald Frantzen (N. Y. N. H. & H.), Wm. Hiles (C. C. C. & St. L.), F. E. Jacobs (C. & W. I.), H. F. Lomas (I. C.), W. B. Morrison (D. L. & W.), G. S. Pflasterer (N. C. & St. L.), E. J. Relph (N. P.), C. Smith (St. L.-S. F.), Chas. Stephens (C. & O.), M. E. Sutherland (Maine Cent.), R. W. Taylor (B. & O.).

Discussion

C. J. Kelloway (A. C. L.), chairman: We have a suggestion under 4, General (y), from Mr. Elsworth regarding counterweights.

W. N. Spangler (Penna.): Counterweights are only to be provided when especially required, reading, "Counterweights for mechanical levers shall be provided 'if' shown in section 12523-R-4-Y." We also suggest that R-4-Y indicate the different sizes of counterweights generally used so that the purchaser would likely pick such a size and avoid special expense in the factory. The specification reads, "Counterweights for mechanical levers shall be provided as shown in section 12523-R-4-Y," thus leaving it optional with the purchaser to state specifically the levers on which he wants counterweights and the size.

T. S. Adams (N. Y. C.): Under 4, General, I would suggest, locking to be specified as merchant bar steel.

Mr. Kelloway: I don't think the committee can go along with the suggestion, as they do not run uniform in size. Cold rolled steel is the only steel that can be used which will run anywhere near uniform size.

L. F. Howard (U. S. & S. Co.): If you call for cold rolled steel you get what you want. If you want merchant bar steel and it is not cut to size you will have to cut it down.

Mr. Kelloway: We have another suggestion under 19, "Lever Light Indicators" (a). It is suggested that the word "as" in the first line be struck out and "if" be inserted. The committee agrees.

We have another suggestion under number 20, Contacts (a).

Mr. Spangler: The first suggestion is made by Mr. Elsworth and reads as follows: "Section 20, Contracts. As we experience much more trouble from lack of good contact than from lack of mechanical strength or current capacity, it is suggested that this point be emphasized and paragraph read as follows:

" 'Contact springs shall be made of highly non-corrosive material of sufficient strength, contact pressure and current capacity to satisfactorily operate in connection with the circuits used.' "

Mr. Kelloway: The committee will accept the suggestion and change paragraph 20.

Mr. Kelloway: We have another suggestion, under 21, time releases. It is suggested that the "as" in the first line be changed to "if". The committee agrees to the change.

T. C. Siefert (C. B. & Q.): Referring to number 18, Detector Locking. I would like to know what the committee had in mind in the "equivalent" of protective circuits, which means nothing.

Mr. Spangler: One of the things I think of is drawbridge locking. Electric lock on an outlying switch is another thing. An outlying switch is electric locked and the switch itself is operated by hand. We want the equivalent of protective circuits. There are, I think, quite a number of cases in which you want protection similar to that provided in electric switch locking and the expression "equivalent" covers it, instead of attempting to enumerate them all.

After an extended discussion on whether blanks should be left in the specifications to allow for variations as may be required, it was brought out that the specification was prepared according to the latest instructions of the Editing Committee. A motion was then presented by Mr. Rudd to the effect that the Administrative Committee of the Committee of Direction take this matter of alternate requisite arrangement under consideration and report at the next meeting. After a short discussion this motion was carried.

Mr. Kelloway: Mr. Ambach calling attention to Section 11, paragraph (b), says it "provides that locking shall be operated by electric levers." I would suggest that the manner of operating the lock be described. We have had some trouble with the geared type. There may be two methods of operation of the lock. There probably can be three methods. One is the bell and crank method, by operating the latch and through bell and crank operating the lock. Another is through crown and gear and the third method through a bar and a vertical rod; in other words, the Z-method.

Mr. Kelloway: The committee is not familiar with the method of operating the locking to which you refer. In the miniature locking of the I. S. & F. machine, I believe you refer to the standard locking or in the S. & F. machine where it is operated by unit electric lever. This specification does not cover that type of machine.

Mr. Ambach: That is what we would like to have cleared up. We have to have some method of driving that miniature locking. How are you going to drive the miniature locking with your lever?

Mr. Spangler: There may be different methods of driving. It may be through rack and pinion. I don't know whether it is permissible for us to specify that it shall be driven by a rack and pinion lever. It may be a driver similar to the one employed in a mechanical machine.

Mr. Kelloway: Mr. Ambach in his letter states regarding Section 17, paragraph (a). Indication. "This paragraph refers to mechanical locking and when comparing this paragraph with paragraph (b) and (f), under locking, it would seem that there are two types of locks in use, one in connection with the use of mechanical levers and the other with electric levers. I believe this should be clear. Under "Locking" (a), machine shall be provided with miniature locking of the preliminary type. (b), Locking shall be operated by electric levers.

Mr. Kelloway explained that the mechanical levers do not operate the locks.

Mr. Kelloway: *I move that the specifications for electro-mechanical interlocking machines—I. S. & F. miniature locking, as revised, be accepted for submission to letter ballot.*

(Motion carried.)

Report of the Committee on Batteries

The specifications for the cylindrical dry cell presented by this committee will establish a standard for this type of battery used by signal departments. Another important feature of the work of this committee was the report on the trickle charge method for charging storage batteries. The committee found that some roads have been using this floating charge method for charging storage batteries, from primary cells since 1900. The advantages and disadvantages of the portable storage battery and the d. c. line charging method for supplying energy to storage batteries used for signal operation were also discussed. The development of the vibrating contact mechanical rectifier has introduced the so-called floating charge method, using ordinarily 220 volts a. c. for the line, which is converted to d. c. by the mechanical rectifier, for charging the storage batteries at the various signal locations. The committee reported that 42 railroads have advised that this system will be used on future installations where practicable. Albert B. Himes, chairman of this committee for the past three years is assistant signal engineer of the Baltimore & Ohio. He started as a batteryman in the signal department of the Lehigh Valley in 1901 and has been a constant student of battery supply for signals since.

Albert B. Himes
Chairman

THE COMMITTEE SUBMITTED A. R. A. Signal section specification No. 12623 for Cylindrical Dry Cells, with the recommendation that it be accepted for letter ballot. A report on the floating charge method of charging storage batteries was presented as information.

Report on Trickle Charge Method for Charging Storage Batteries

The trickle or floating charge method of charging storage batteries has been in use for a great many years. Practically all traction lines in the past have used large storage batteries floated across their generators. These batteries having taken on a charge during the slack hours of traffic, when the full generator capacity was not needed to handle the cars on the line, and then discharged during the heavy hours when the generators did not have capacity enough to handle the traffic.

This same principle has been followed in a number of other lines where the peak of the load was of short duration and it was not considered economical to install generator capacity sufficient to handle this peak. It has also been used in cases where the supply of power was not sufficiently uniform or reliable to serve the purpose for which required.

The first use of the trickle charge or floating system to railway signal service was about 1900, when one large system started the use of storage batteries for signal operation, charging them from primary cells. While this system was taken up by several other roads to a greater or less extent, it is now almost extinct on account of the excessive cost of power derived from such a source.

Throughout all of these uses of the floating system of charging storage batteries it was demonstrated that batteries charged in this manner had a considerably longer life and were less subject to trouble than the same types charged in any other manner. Efforts had already been made to utilize storage batteries for automatic signal operation by the use of portable batteries under two general schemes of operation, the most common of which was to ship the discharged batteries to a permanent charging plant and after being charged they were returned to the territory from which shipped.

The other was by using a car equipped with gasoline engine generator set and an attendant which made periodical trips over an assigned territory, stopping at points where an accumulation of exhausted batteries was located, and after completely charging and overhauling the batteries at that location, move on to the next.

The use of portable batteries had several disadvantages: 1. Damage to batteries in shipment. 2. Cost of handling. 3. An excess of batteries varying from 25 to 50 per cent had to be provided to handle the work while other batteries were being charged, this materially increasing the original cost.

A scheme was then devised to run a d.c. line in each direction from a point where such current was available and by means of specially designed switches connect one battery at each battery location in series with this d.c. line, and cause a second set to do the work required at that location. Current was then caused to flow in this d.c. line at rates varying from 5 to 10 amp. driven by 500 or 600 volts.

This scheme, although used to a large extent on several roads, has some disadvantages: 1. Two complete sets of battery and a charging switch for each location must be provided. 2. Line must be of low resistance to prevent excessive drop in voltage. 3. Attendance must necessarily be great as switches must be thrown at frequent and regular intervals.

With this knowledge at hand a number of efforts were made to devise a scheme whereby trickle charge of batteries of low voltage could be accomplished at a reasonable power cost.

As practically all commercial sources of power were alternating current, attention was turned to the development of a rectifier that would operate on an economical basis and at the same time be reliable.

A number of electrolytic rectifiers were produced with more or less success, but the efficiency was low and troubles with the internal resistance changing so that they could not be entirely depended upon, and in addition the electrolyte was subject to freezing when in low temperature.

The Tunger rectifier was produced, which has proven satisfactory and economical when operated at rated capacity, but a rectifier of this type has not yet been produced that will give entire satisfaction in charging batteries for the average automatic signal location when the average charge is from 300 to 500 milliamp.

In recent years attention has been turned to the development of a mechanical rectifier for this service. The earlier designs of this type of device gave some trouble due to sticking of contacts, which in some instances discharged the battery through the rectifier, but in the later designs this trouble appears to have been entirely overcome with the result that mechanical rectifiers are now in use to some extent on over 40 railroads. This committee has been advised by 42 railroads that trickle charge would be installed in the future where practicable. It might be well to mention that patent No. 1,316,738 has been granted to Messrs. Phinney and Beck, covering the a.c. floating battery system.

There are at present at least four mechanical rectifiers on the market that have been developed to the point where their use can be adopted without danger of serious trouble.

Nearly 20 years ago the use of a motor-generator set for floating or trickle charge of storage battery was used to a slight extent and scattered installations of this nature have been used up to the last few years, when their use has become more or less common, particularly where the average discharge rate is greater than can be economically handled by mechanical rectifiers.

Committee: A. B. Himes (B. & O.), chairman; A. H. McKeen (U. P.), vice-chairman; H. D. Abernathy (N. Y. C.), R. F. Annear (C. R. I. & P.), J. G. Bartell (L. V.), H. Hobson (A. T. & S. F.), E. W. Kolb (B. R. & P.), E. B. Pry (Penna.), S. U. Rhymer (C. & A.), E. L. Watson (P. R. R.), A. H. Yocum (P. & R.).

Discussion

A. H. McKeen (U. P.), vice-chairman: This specification was reviewed at the November meeting and *we now submit it for submission for letter ballot and for inclusion in the Manual and I so move.* (*Motion carried.*)

H. S. Balliet (N. Y. C.): I would suggest that the

committee enlarge on what they have stated in this brief synopsis on the trickle charge method. If they do not care to print it the secretary will be glad to have it in the records. We would like to have this just as complete as we can for historical purposes. So many of the statements contained herein are brief.

Mr. McKeen: The committee will be very glad to consider that.

R. B. Elsworth (N. Y. C.): If the committee is further to amplify this subject, I would suggest that the discussion be made a little more consistent. You have stated very definitely the disadvantages and not the advantages of the other system and the advantages and not the disadvantages of the trickle charging.

F. W. Bender, (C. R. R. of N. J.): I was wondering whether the patent that is referred to by the committee, would in any way limit us to the type of battery we must use in trickle charging. In other words, we have a number of different types of battery on our roads and a number of batteries that the car lighting people turned over to us, that we can use for trickle charging, but if we are limited to the use of a particular type of battery, under this patent, we could not carry out that practice of taking batteries from another department.

H. M. Beck (Electric Storage Battery Co.): As I understand, the patent does not specify any particular type of battery, but the patent is controlled by a battery manufacturer. It is a question of policy with him as to whether he will limit its use to a particular type of battery or not, and I do not think a final policy has been laid out in regard to that. If it has, I am not in a position to state it, but that patent could be used to enforce any kind of battery, I think.

Mr. Bender: It may be?

Mr. Beck: If it is desired to do so.

Mr. Bender: Then I would ask that the committee have an opinion, a legal opinion, on this, so that we will not get into trouble in a case of this kind, and if we can get a definite opinion from this committee, from a legal point of view, we will know where we are at.

F. P. Patenall (B. & O.): I would like to know what the committee has in mind in making this report in this way, particularly referring to the patent itself. Personally, I do not believe the patent will hold. I do not see how railroads can be limited to using a particular type of material, especially in battery charging.

(*The report on the trickle charge method of charging storage batteries was accepted as information.*)

Report of Committee on Wires and Cables

THE COMMITTEE SUBMITTED as information a report on the investigation and test of wires and cables for railway signaling and recommended revisions of specifications.

The committee conferred with the manufacturer's engineers on the question of revising the specification of rubber insulation. The committee asked that discussion be held on Paragraph 1-a. "A double coating of tin be required on the conductor."

The following changes were made in Paragraph 2-c:

Ingredient	Percentage by Weight
Up river, fine, dry Para rubber	30. and 33.
Sulphur	Not more than 2.
Parafine or ozokerite	Not more than 2.
Whiting	
Zinc oxide	
Litharge	

The following changes were made in 11-a: The minimum allowance of free sulphur be eliminated and the maximum free sulphur be limited to not more than seven-tenths of one per cent.

Committee: E. G. Stradling (C. I. & L.), chairman; H. G. Morgan (I. C.), vice-chairman; B. T. Anderson (D. L. & W.), John Leisenring (Ill. Trac.), H. W. Lewis (L. V.), R. M. Phinney (C. & N. W.), W. M. Post (Penna.), A. H. Rice (D. & H.), W. Y. Scott (B. & M.), T. S. Stevens (A. T. & S. F.).

Discussion

E. G. Stradling (C. I. & L.), chairman: The manufacturers state that they have no objections to these changes in the specification.

F. B. Wiegland (N. Y. C.): Does the committee recommend double coating or single coating of tin.

Mr. Stradling: The committee recommends double coating.

Mr. Wiegand: I understand that with single coating of tin, by weight we have 0.54 whereas with a double coating of tin by weight we have 0.23. Has the committee investigated that?

Mr. Stradling: The committee has not.

T. C. Siefert (C. B. & Q.): Has the committee considered revising the specification to include the 3/64 in. wall insulation. It is our contention that 3/64 in. wall is ample and we do not see the necessity of a 5/64 in. wall.

A. H. Rudd (Penna.): I certainly hope the committee won't even stop to consider 3/64 in. wall. We have had our experience with it and would not use it.

J. A. Peabody (C. & N. W.): We have had a lot of experience with 3/64 in. wall and I would support Mr. Siefert's suggestion that this be considered. We have been using it for many years—with very good results. We are using 3/64 in. wall for cabling and 5/64 in. for underground and we are buying it under the specifications. Cannot either be purchased under the present specification?

Mr. Siefert: I would like to have the committee explain why we require a 5/64 in. wall. We find it is not a question of strength or insulation resistance, it is just a question of mechanical strength which can be better obtained by a tape and braid than by the thickness of rubber.

Mr. Stradling. I believe any of the wire manufacturers will furnish you R. S. A. wire under the specifications if you put in your requirement that it be 3/64 in. instead of 5/64. You will get the same insulation with the exception of the difference in the thickness of the walls.

Chairman Christofferson: Will Mr. Keefe give us a little information in regard to tinning?

T. A. Keefe (Hazard Mfg. Co.): Our tests on so-called double tinning of copper wire for rubber covering has been that the single tinning is amply sufficient provided, of course, it is applied properly. Tests show that a single tinning gives .54 per cent of tin by weight on the wire, whereas, if you give it the double tinning you reduce that amount of tinning to .23 per cent. Our tests further show that samples of single tinning and double tinning withstood the sixth immersion test without blackening, and after the seventh test black spots appeared on both samples.

F. W. Bender (C. R. R. N. J.): We have a specification which says that the wire shall stand a number of immersions in a bath of sulphuric acid or some other substance. Now instead of saying that it be one or two coats of tin on the copper why should we not strengthen this test, if we are not getting the results from the tinning at the present time with a single coat?

Mr. Hood (American Steel & Wire Co.): The quan-

tity of tin on the wire is largely determined by the temperature at which the tin bath is run and the quality of the single or the double tinning would depend upon the temperature of the bath. One argument in favor of the double tin coating is that the second coating can be kept more free from small copper articles than the first tin coating.

Mr. Bender: Do the tests show whether we have one coating or two coatings of tin on the copper.

Mr. Hood: No, I do not think any test that you can apply would show whether you have one coating or two coatings. The heavier the coating of tin the more dips it should stand, but whether or not it was applied by single or double coating I do not think any test would show.

Mr. Wiegand: Before the committee is dismissed I would like to have them tell us just why they eliminated the minimum allowance of free sulphur.

Mr. Stradling: I believe that the wire manufacturers felt that that amount could be reduced.

Chairman Christofferson: Mr. Siefert, do you care to make a motion to include 3/64 in. wall in the specification?

Mr. Siefert: *I move that the committee reconsider the 3/64 in. insulation with tape and braid.*

Mr. Stradling: If Mr. Siefert will write us a letter stating just what points he wants us to consider we will give it the consideration without a motion here.

Chairman Christofferson: You will do that, Mr. Siefert?

Mr. Siefert: Yes.

Report of Committee on Contracts

Contracts between railroads covering the joint ownership, maintenance and operation of interlocking plants have been the source of much contention as long as railroads have crossed one another. Every time either road wishes to make changes or additions to its equipment the contract is opened and arguments ensue. Therefore, the report of this committee, presenting a unit basis for the distribution of the costs of constructing, maintenance and operation of interlockings, will serve as a guide for the drafting of contracts for joint interlockers on an equitable basis. The report includes a typical form for recording the units, together with a detailed explanation of the various applications of the information recorded. To ascertain to what extent the joint interlocking plants use the same proportions for operation and maintenance, studies were made of 120 mechanical and power plants in which 47 different carriers were interested. It was found that 83 plants or 69 per cent of the total number used the same proportions for both operation and maintenance while 37 plants, or 31 per cent of the total, used an arbitrary basis as outlined in old agreements. G. E. Beck, signal valuation engineer of the New York Central, Cleveland, O., has been chairman of this committee for two years.

G. E. Beck
Chairman

THE COMMITTEE RECOMMENDED the application of the unit basis for the drawing up of contracts for interlocking plants.

A form for recording unit values at interlocking plants was submitted for use with the table of unit values which has been approved by letter ballot. It has been so designed that for size and with the information thereon, it can be used as an exhibit, to form part of an agreement. The committee recommended that this form be accepted for submission to letter ballot.

Example of Use of Unit Basis

The committee presented an example of the use of the unit basis for ownership, distribution of expense of construction, operation, and maintenance of joint interlocking plants.

Exhibits A, B, and C cover a mechanical interlocking plant which was constructed, operated and maintained 50 per cent by each of the original users. During 1918, another carrier was admitted into the interlocking and pays 100 per cent of the cost of 24 units added for its benefit. The carrier entering the plant will be billed for its proportion of original tower and out-buildings and if this carrier does not provide lever extension to the machine, it is billed for its proportion of the original machine in proportion to number of levers used.

Exhibit "A".—At the time this change is made the two parties in the original plant decide to make some changes, consisting of 16 units for the benefit of one of them, and 32 units which they agree are joint on the original basis 50-50.

At this time there is also a retirement of 2 units, because of changing from 2-position signals to 3-position signals. As the original 2-position signals were on a 50-50 basis, the unit retirement is made from joint units total, and the two original roads share in credit for salvage.

The entire plant as now rebuilt is apportioned on the unit basis and a summary shows that the proportions of each company for the year 1918 are as follows:

A. B. R. R.	47.60	per cent
C. D. R. R.	37.95	" "
E. F. G. R. R.	14.45	" "
	100.00	" "

Exhibit "B".—During 1919 certain additions are made to the plant and each carrier participates in the cost of construction, in the proportion that the number of units installed for its benefit bears to the total units installed.

This proportion is determined as follows:

A. B. R. R.	12	units	60 per cent
C. D. R. R.	4	"	20 " "
E. F. G. R. R.	4	"	20 " "
	20	"	100 " "

We now have a plant in which the unit proportion of the whole has changed and have determined that each carrier is now responsible for the proportion which from the summary for 1919 is as follows:

A. B. R. R.	48.93	per cent
C. D. R. R.	36.02	" "
E. F. G. R. R.	15.05	" "
	100.00	" "

Exhibit "C".—In 1920, to care for heavy rail, it is decided to remove bars and substitute electrical route locking protection. The cost of making this change is apportioned to each carrier in proportion to units installed for its benefit, and this proportion is as follows:

A. B. R. R.	12	units	20.69 per cent
C. D. R. R.	24	"	41.38 " "
E. F. G. R. R.	22	"	37.93 " "
	58	"	100.00 " "

The 28 units for bars retired are retired from the 186 joint units and each carrier participates in credit for salvage to the extent of its proportion in 186 units which would be as follows.

A. B. R. R.	48.93	per cent
C. D. R. R.	36.02	" "
E. F. G. R. R.	15.05	" "
	100.00	" "

The plant now having been increased to 244 units, less 28 units retired, leaves 216 units in service and the responsibility of each carrier's proportion of the whole for 1920 has now changed to the following:

A. B. R. R.	41.34	per cent
C. D. R. R.	37.46	" "
E. F. G. R. R.	21.20	" "
	100.00	" "

It is recognized that where the old agreements do not provide for unit proportions, the division being made on flat lever or arbitrary basis, the unit basis cannot be used unless the interested carriers agree to such unit use, but all new agreements should recognize the unit basis when they are drawn up.

A study of 12 mechanical and power plants representing 739-75 units assigned on the lever and arbitrary basis and 3004 units on the A.R.A. basis shows that the difference was 1.02 per cent on the average for the 12 plants.

up percentage of responsibility to each party, which should cover both operation and maintenance, unless exceptional operating conditions are present at some individual plant.

To ascertain what proportion of joint interlocking plants use the same proportion for operation and maintenance, 120 mechanical and power plants were studied, in which plants 47 different carriers were interested. It was found that 83 plants or 69 per cent of the total number used the same proportion for both operation and maintenance. The 37 plants, or 31 per cent

EXHIBIT "A"

Additions are made to the original plant and a new road is taken in. Two signals are retired.

UNITS	Unit Values	Original Plant Joint A.B.R.R. 50% C.D.R.R. 50%	Additions 1918 A.B.R.R. 100%	Additions 1918 Joint A.B.R.R. 50% C.D.R.R. 50%	Additions 1918 E.F.G.R.R. 100%	Totals
10 derails	4 each	32	..	..	8	40
10 signals, 2 position	4 "	32	..	..	8	40
10 F. P. locks	2 "	16	..	..	4	20
550′ detector bar	2-55 ft. or fraction	16	..	..	4	20
2 signals, 3 position	6 each	..	12	..	..	12
2 track circuits	2 "	..	4	..	..	4
4 switches	4 "	..	..	16	..	16
4 F. P. locks	2 "	..	..	8	..	8
220′ detector bar	2-55 ft. or fraction	..	..	8	..	8
		96	16	32	24	168
Less 2 signals retired	1 each	2	..	..	..	2
Totals		94	16	32	24	166
Per cent		56.62%	9.66%	19.27%	14.45%	100%

Summary 1918

A. B. R. R. proportion 50% of 56.62%+100% of 9.66%+50% of 19.27%=47.60%
C. D. R. R. " 50% of 56.62%+ 50% of 19.27% =37.95%
E. F. G. R. R. " 100% of 14.45% =37.95%
100%

EXHIBIT "B"

Twenty units are added to the plant.

UNITS	Unit Values	Plant as of 1918 Joint A.B.R.R. 47.60% C.D.R.R. 37.95% E.F.G.R.R. 14.45%	20 unit addition 1919 A.B.R.R.	C.D.R.R.	E.F.G.R.R.	Totals
		166				166
3 switches	2	..	4	2	..	6
3 F. P. locks	2	..	4	2	..	6
2 2 position signals	4	..	4	..	4	8
Totals		166	12	4	4	186
Per cent		89.25%	6.45%	2.15%	2.15%	100%

Added 1919 (Cost apportioned)

A. B. R. R.	12	units	60%
C. D. R. R.	4	"	20%
E. F. G. R. R.	4	"	20%
	20	"	100%

Summary 1919

A. B. R. R. proportion .....47.60% of 89.25%+100% of 6.45%=48.93%
C. D. R. R. " .....37.95% of 89.25%+100% of 2.15%=36.02%
E. F. G. R. R. " .....14.45% of 89.25%+100% of 2.15%=15.50%
100.00%

EXHIBIT "C"

Fifty-eight units are added to the plant and all bars are retired.

UNITS	Unit Value	Plant as of 1919 Joint A.B.R.R. 48.93% C.D.R.R. 36.02% E.F.G.R.R. 15.05%	58 unit addition 1920 A.B.R.R.	C.D.R.R.	E.F.G.R.R.	Totals
		186				186
6 track circuits	2 each	..	4	4	4	12
4 signals, 3 position	6 each	..	..	12	12	24
10 electric locks	1 each	..	4	4	2	10
6 annunciators	1 each	..	2	2	2	6
6 indicators	1 each	..	2	2	2	6
Totals		186	12	24	22	244
Less 770 ft. detector bar retired 2-55 ft or fraction		28	..	..	..	28
Totals		158	12	24	22	216
Per cent		73.15%	5.55%	11.11%	10.19%	100%

Added 1920 (Cost apportioned)

A. B. R. R.	12	units	20.69%
C. D. R. R.	24	"	41.38%
E. F. G. R. R.	22	"	37.93%
	58	"	100.00%

Summary 1920

A. B. R. R. proportion .....48.93% of 73.15%+100% of 5.55%=41.34%
C. D. R. R. " .....36.02% of 73.15%+100% of 11.11%=37.46%
E. F. G. R. R. " .....15.05% of 73.15%+100% of 10.19%=21.20%
100.00%

Construction and Ownership

The unit basis readily lends itself to division of ownership of a plant on the construction investment basis, which in turn can be said to represent a carrier's proportion of responsibility in the plant and therefore should determine its proportion of construction charges and ownership.

Operation and Maintenance

As the interlocking plant is composed of various units for which each road is responsible for its part, the unit basis will set

of the total, used an arbitrary basis as outlined in old agreements and generally applied to the older plants.

There seems to be no good reason why construction costs, ownership, operation and maintenance of new plant should not be on a percentage basis, each carrier assuming its obligations as defined by the unit basis and resulting percentages. By placing new work or additions to an old plant on the unit basis, the engineer can work up his rough plans of proposed layout, agree with interested parties on responsibility for units involved and establish percentages to be used in making up authority for expenditure (A.F.E.) without having to measure up materials or

build up bill of material. There is also a decided advantage in being able to report the new job or addition, as a whole, in charging out material and labor on the unit basis percentage.

The committee recommended that the report on the use of the unit basis be accepted as information.

Committee: G. E. Beck (N. Y. C.), chairman; W. F. Seemuth (C. M. & St. P.), vice-chairman; J. D. Jones (Penna.), J. C. Mock (M. C.), H. C. Lorenzen (P. M.), Leroy Wyant (C. R. I. & P.).

Discussion

W. M. Post (Penna.): My impression is that the note on the form provided for the cost of operation, as well as the maintenance, is to be divided on the unit basis as shown in the table. As it happens, maintenance is divided on the unit basis but operation is not, and it seemed to us it would be better to leave the note off so that the table could be used on the division of the cost of maintenance but not necessarily of operation.

G. E. Beck (N. Y. C.), chairman: The note reads as follows: "Section I of agreement: The percentage of the cost of maintenance and operation of the interlocking plant to be borne by the parties hereto under the aforesaid agreement shall be divided, on a unit basis, according to the plan and schedule marked, respectively, Exhibits A and B, signed by the parties hereto and attached to and make a part of the agreement. It is expressly understood and agreed that said exhibits shall supersede similar exhibits to be signed by the parties hereto and attached to and made a part of this agreement without abrogating or otherwise modifying the same as changes are made in the units of the parties hereto."

Mr. Beck: If it is the sense of the meeting that this note be eliminated the committee is agreeable.

(A motion to eliminate this note was carried.)

A. R. Fugina (L. & N.): I would suggest that the size of the sheet on which this form should be printed be shown as a footnote.

Mr. Beck: The committee will accept that.

(A motion to the effect that the form be accepted for submission to letter ballot, was carried.)

Mr. Beck: As an example of the use of unit basis we have taken one of the old time plants owned on a fifty-fifty basis. By using the unit basis a flexible system is secured which would cover almost any condition in the construction field.

(A motion to accept this report as information was carried.)

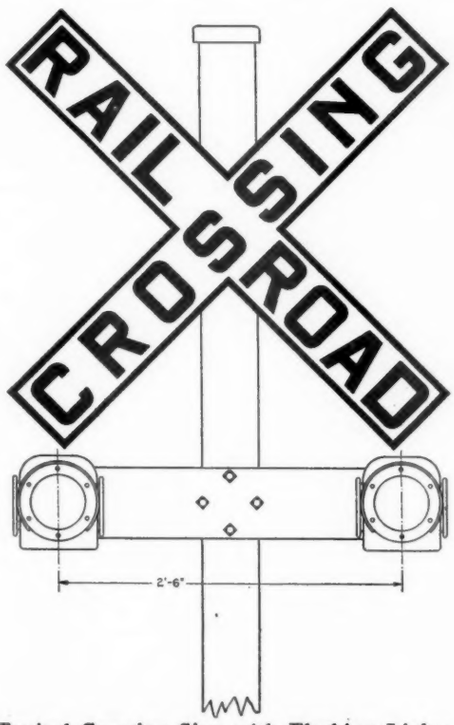
Mr. Beck: The committee recommended that certain clauses in "general provisions" for use in major specification be included in the form "Invitation To Bidder" and "Contract for Block Signal and Interlocking Work."

(These changes were accepted for submission to letter ballot.)

Report of Committee on Highway Crossing Protection

THE OUTLINE OF WORK assigned at the last annual meeting was changed immediately preceding the November stated meeting in New York, to read as follows:

Report on the standardization of aspects for mechanical or electrical devices at highway crossings, as a substitute for crossing watchmen, gatemen or flagmen.



Typical Crossing Sign with Flashing Lights

The report of the committee, printed in the advance notice of the November meeting and covering various phases of highway crossing protection, was, therefore, withdrawn, the chairman making a verbal statement giving the reasons therefor, as instructed by a majority of the committee at a meeting held previous to this action.

Acting on the new assignment, a majority of the committee met following the November stated meeting, examined a signal consisting of two horizontal alternately flashing lights, which it was found presented the appearance of a single swinging light, and unanimously passed a resolution, which was submitted to the absent members, some of whom have seen the exhibit since, voted on and slightly modified by letter, and is presented below as amended as the recommendation of the committee.

If this recommendation is approved and accepted by letter ballot, specifications should be prepared.

Recommendation: Resolved, "That an electrically or mechanically operated signal, used for the protection of highway traffic at railroad crossings, shall present toward the highway, when indicating the approach of a train, the appearance of a horizontally swinging red light and or disc."

Drawing of these lights and of the wig-wag signal, conforming to the above recommendation, are presented herewith.

The committee recommended that the report be accepted for submission to letter ballot.

Committee: A. H. Rudd (Penna.), chairman; C. J. Kelloway (A. C. L.), vice-chairman; J. A. Peabody (C. & N. W.), vice-chairman; W. J. Eck (Sou.), A. R. Fugina (L. & N.), H. W. Lewis (L. V.), H. K. Lowry (C. R. I. & P.), A. H. McKeen (U. P.), C. H. Morrison (N. Y. N. H. & H.), H. H. Orr (C. & E. I.), F. P. Patenall (B. & O.), W. Y. Scott (B. & M.), M. E. Smith (D. L. & W.), T. S. Stevens (A. T. & S. F.), C. F. Stoltz (C. C. C. & St. L.), W. M. Vandersluis (I. C.).

Discussion

A. H. Rudd (Penna) chairman: We wish to make a certain change in the report. A statement was made, "Drawings of the lights and of the wig-wag signal, conforming to the above recommendations, are presented herewith." We wish to have that appear as these drawings are presented as information, we do not want these drawings adopted to go in the manual.

I move that the resolution in the report accepted for submission to letter ballot, and that the committee of direction be requested to submit it to C. L. Bardo (N. Y. N. H. & H.) who is chairman of the committee on highway crossing protection of the operating division A. R. A.

(The motion was carried.)

The committee offers the following resolution: "Resolved, that the officers and Committee of Direction of the Signal section Engineering division, IV, A. R. A. be and they hereby are, authorized and instructed to, if possible, patent or copyright the use of the two alternately flashing lights presenting the appearance of a horizontal swinging red light to indicate at the crossing of a highway with a railroad (steam or electric) the approach of a train."

The reason we are asking this is that the wig-wag has been used for perhaps two or three years for advertising purposes. The horizontal flash light resembling a swinging light is a development of this committee and we think it is brand new. We want to restrict its use to the indication that a train is approaching. If we can get that copyrighted, we will use it only for protecting trains. *I move this resolution be adopted.*

L. S. Brach (Brach Mfg. Co.): I have patents on reflecting swinging lanterns with stationary lights, and it seems to me that if all but two of my lights went out accidentally we would be infringing on the patent. However, I am perfectly satisfied to devote all of the patents that I hold on that subject to the association.

Mr. Rudd: Mr. Brach has for a long time been very liberal. The idea, Mr. Brach, is not to patent this in order to bar anybody, but it is to bar its use anywhere except to protect highway crossings.

Mr. Brach: My suggestion was only for the purpose of any benefits that the association may find in any patent that I have on the subject.

Mr. Rudd: We planned to make the specification so broad that nobody will have any kick on it. We want to keep this thing for highway crossings of a railroad to indicate approaching trains.

(A motion to approve the resolution was carried.)

G. E. Beck (N. Y. C.): *I move that a vote of thanks be extended to Mr. Brach for his consideration in offering the association the use of his patents. (Motion carried.)*

Report of Committee on Power Interlocking

Specifications for three important accessories for interlocking plants; time locks, time releases and a drawbridge circuit controller, were included in the report of this committee. The purpose of a time lock is to prevent the complete release of an interlocked route for a predetermined period of time. The time release is for the direct or indirect control of circuits involved in the operation of interlocked or other signal functions for a definite period. For example, a time release may be used at an interlocking plant to prevent the towerman from changing a route set up for an approaching train, until sufficient time has elapsed for the train to stop or for the engineman to see the change in the signal indication. The drawbridge circuit controller is a device for connecting the signal circuits between the shore and the bridge ends of a drawbridge, when the bridge is closed. The use of this device will in many cases obviate the installation of an expensive submarine cable. Standardization of these three devices will facilitate the manufacture and permit the railroads to make additions and alterations to existing equipment with the least expense. F. W. Pfleging, signal engineer of the Union Pacific, has been chairman of this committee for two years and served as chairman of the Signal section in 1920.

F. W. Pfleging
Chairman

THE COMMITTEE SUBMITTED three specifications. Specifications 12723 and 12823 were for time locks and time releases respectively and were submitted for discussion. Specification 13023 covered drawbridge circuit controllers and was presented for submission to letter ballot.

Time Locks

1. Purpose.—(a) The purpose of this specification is to provide apparatus which will prevent complete release of an interlocked route for a predetermined period of time.

(Sections 2, Tender; 3, Alternate requisites; 4, Material and workmanship, and 5, Inspection, are standard sections.)

6. General.—(a) Mechanism shall be so constructed that the several parts may be readily removed. (b) Time locks shall be positive in action and free from mechanical defects in material and construction. (c) Unless otherwise specified in section 12723-R-6-c, time locks shall be furnished complete with fittings for attachment to the machine and lever. (d) Each lock when actuated by the controlling lever being either partially or fully reversed shall immediately secure locking in the machine against all conflicting lever operations and hold the same until the lever has been returned to the full normal position and the proportional time interval has elapsed.

7. Design.—(a) Time locks shall be of a design as specified on the requisite sheet. (b) Like parts of the same manufacturer's apparatus shall be interchangeable. (c) Time locks shall be separate units with separate levers and arranged to allow application to adjacent levers. (d) Metal cover shall be provided which when removed will permit access to all parts. (e) Time locks used outside of machine cabinets shall have covers arranged for sealing or locking with purchaser's standard padlock or screw lock with ½ in. yoke. (f) Locks shall be designed to prevent improper manipulation or change in adjustment without unlocking or breaking the seal. (g) Provision shall be made for proper lubrication of all bearings and movable parts. (h) Where springs are used in the mechanism of locks, the application shall be such that the breaking of a spring will not permit the premature release of the locking arrangement.

8. Timing Period.—(a) Timing periods shall be as specified in section 12723-R-8-a.

9. Contacts.—(a) The number and adjustment of contacts shall be as specified in section 12723-R-9-a. (b) Contact shall be of substantial design with tungsten or silver contacting points rigidly fastened to members. (c) The movement of the contact members shall insure a wiping contact. (d) Current carrying parts shall be designed to carry 5 amperes continuously at 110 volts. (e) Contact opening shall not be less than 1/16 in.

(Sections 10, Dielectric requirements, and 11, Insulation, are general electrical requirements. Sections 12, Packing; 13, Marking, and 14, Warranty, are standard sections.)

Time Releases

1. Purpose.—(a) The purpose of this specification is to provide apparatus for the direct or auxiliary control of circuits involved in the operation of interlocked or other signal functions for a predetermined period of time.

(Sections 2, Tender; 3, Alternate requisites; 4, Material and workmanship, and 5, Inspection, are standard sections.)

6. General.—(a) Releases must be positive in action and free from mechanical defects in material and construction. (b) No fittings for attachment of releases to machine and, or lever shall be furnished unless so specified in section 12823-R-6-b. (c) Circuits controlled by mechanism of releases shall become operative or inoperative when the controlling force has been effective for 10 per cent of the complete movement as specified in section 12823-R-8-a.

7. Design.—(a) Time releases shall be of a design as specified on the requisite sheet. (b) Like parts of the same manufacturer's apparatus shall be interchangeable. (c) Releases shall be separate units with separate covers and arranged for application as specified in section 12823-c. (d) Dust proof covers shall be provided which when removed will permit of access to all contacts, binding posts and means of adjustment. (e) Releases mounted outside of the machine cabinets shall have covers arranged for sealing, or locking with purchaser's standard padlock or screw lock with ½ in. yoke. (f) Releases shall be designed to prevent improper manipulation or change in adjustment without unlocking, or breaking of seal. (g) Provision shall be made for proper lubrication of all bearings and movable parts. (h) Where springs are used in the mechanism of releases, the application shall be such that the breaking of a spring will render the mechanism inoperative. (i) Provision shall be made in the base of the mechanism for the entrance of wires or cables as specified in section 12823-R-7-i. (j) Releases shall be designed so that the time interval can be varied to any time between 10 sec. and 4 min.

8. Timing Period.—(a) Timing periods shall be as specified in section 12823-R-8-a.

9. Contacts.—(a) Number and adjustments of contacts shall be as specified in Section 12823-R-9-a. (b) Contacts shall be of substantial design with tungsten or silver contacting points rigidly fastened to each member. (c) The moving of the contact members shall be such as will insure a wiping contact. (d) Current carrying parts shall be designed to carry 5 amperes continuously at 110 volts. (e) Contact opening shall not be less than 1/16 in.

10. Binding Posts.—(a) Binding posts shall be of brass and so arranged that they cannot be turned in the base or frame to which they are fastened.

(Sections 11, Dielectric requirements, and 12, Insulation, are general electrical requirements. Sections 13, Packing; 14, Marking, and 15, Warranty, are standard sections.)

Drawbridge Circuit Controller

First and Second Range Voltage

1. Purpose.—(a) The purpose of this specification is to provide apparatus to control the connection of railway signal and other circuits between the shore and bridge ends of a drawbridge.

2. Drawings.—(a) Purchaser's drawings accompanying this specification and forming an essential part thereof, are as shown in section .....

(Sections 3, Tender, and 4, Alternate requisites, are standard sections.)

5. Design.—(a) Like parts of the same manufacturer's controllers of the same design shall be interchangeable. (b) Controller shall be inclosed in a substantial metallic case with cover and be equipped with a hasp lug having a minimum opening of ⅝ in. for the application of a lock. The cover when opened shall provide access to all parts. (c) Controller contacts shall function properly with a maximum longitudinal variation of 4 in. between the two anchors of the controller. (d) Contacts shall be self-centering and function properly with a maximum variation of ½ in. between centers. (e) Bolts and screws ¼ in. in diameter and larger shall have U. S. Standard thread; screws less than ¼ in. diameter shall be A. S. M. E. Standard thread. (f) Bolts and cap screws shall be provided with lock washers where practicable. (g) Not less than 4 lugs, two on each side, with holes for ¾ in. bolts, shall be provided for fastening each member in place. (h) The movable member of the controller shall be designed for the application of standard A. R. A. or R. S. A. fittings for 1 in. pipe. (i) Two wire entrances located at the corners nearest the wire terminals shall be provided in each member of the controller. Entrances shall be fitted with metal covers which may be replaced with a wire entrance adapter casting. (j) Minimum area of each wire entrance shall be 2½ in. square or its equivalent, no dimension to be less than 2 in. in controllers up to and including 20-way. In accordance with section....., in controllers of greater capacity the area of wire entrances shall be increased on the basis of 1/5 sq. in. per additional way. (k) Wire entrance adapter casting shall be provided as specified in section ..... (l) Provision shall be made for properly supporting wires inside the controller between the wire entrance and terminals.

6. Binding Posts.—(a) Binding posts shall be No. 107015, A. R. A. drawing 1070, attached to the immovable part of the controller, and so arranged that they cannot turn in the support, or loosen the electrical connection through shrinkage of the material used.

7. Contacts.—(a) Contacts shall: 1. Make a wiping contact. 2. Be of phosphor bronze, or as specified in section ..... (3) Be designed to carry continuously and break the current as specified in section .....

(Sections 8, Dielectric requirements, and 9, Insulation, are general electrical requirements.)

10. Painting.—(a) Metallic case and cover shall be painted in accordance with A. R. A. Signal Section Specifications for Paint and Painting.

11. Finish.—(a) Finished metal parts shall be protected against corrosion excepting where such protection will interfere with the proper functioning of that part. (b) material used for protection against corrosion shall neither soften nor flake under ordinary conditions between temperatures of 40 degrees C. (40 degrees F.) below zero, and 85 degrees C. (185 degrees F.) above zero.

(Sections 12, Material and workmanship; 13, Inspection, and 14, Tests, are standard sections.)

Committee: F. W. Pfleging (U. P.), chairman; B. J. Schwendt (T. & O. C.), vice-chairman; W. C. Sibila (N. Y. C.), vice-chairman; F. J. Ackerman (K. C. T.), E. T. Ambach (B. & O.), F. L. Ball (D. L. & W.), F. A. Beck (Penn), E. N. Fox (B. & M.), D. W. Fuller (A. T. & S. F.), James Fultz (T. St. L. & W.), J. H. Oppelt (N. Y. C. & St. L.), C. D. Rex (Sou.), S. Riddle (L. V.), T. C. Seifert (C. B. & Q.), Walter Tyler (L. I.), O. R. Unger (M. P.), W. R. Young (G. T.), G. A. Ziehlke (U. P.).

Discussion

F. W. Pfleging (U. P.) chairman: We should like to hear from the association as to whether you wish an independent specification or one general specification for time locks.

A. H. Rudd (Penna.): We can well leave that to the discretion of the committee in view of the assignments for next year.

J. E. Stephenson (Gen. Ry. Sig. Co.): In paragraph 6 (c) I assume that the time specified for the operation of contacts is a maximum time. If that is the case I will suggest that the paragraph be changed to read, "Circuits controlled by mechanism of releases shall become operative or inoperative when the controlling force has been effective for not to exceed 10 per cent of complete movement as specified in section 12823-R-8-a."

Mr. Pfleging: The committee will consider it.

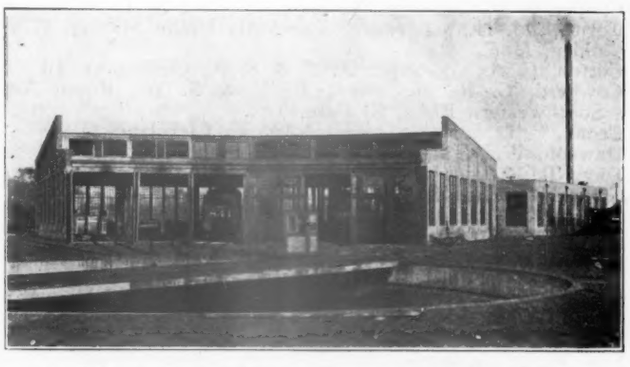
G. H. Dryden (B. & O.): The draw-bridge circuit controller should be provided with a metal cover, waterproof and properly ventilated.

Mr. Pfleging: The committee believes it is sufficiently ventilated by the various openings it has in it.

Mr. Pfleging: *I move that the specification drawbridge circuit controller, first and second range voltage, be submitted to letter ballot.*

(*Motion carried.*)

* * *



Illinois Central Roundhouse at Princeton, Ky.

Registration of Signal Section, A. R. A.

REGISTRATION OF MEMBERS and guests of the Signal section, American Railway Association, at the Drake Hotel yesterday totaled 451 as compared with the similar registration for the first day last year of 334. This registration for the one day exceeded the largest registration ever recorded for any former annual meeting. The previous record was established at Bluff Point in 1914 where the total registration was 429.

Representative Members

Adams, T. S., sig. supr., N. Y. C., 113 Park Ave., Watertown, N. Y.
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Anderson, B. T., asst. sig. engr., D. L. & W., Hoboken, N. J.
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Bennett, C. H., sig. supr., L. & H. R., Warwick, N. Y.
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Charlton, R. C., sig. engr., Ore.-Wash. R. R. & Nav. Co., Portland, Ore.
Christein, Nels, sig. supr., C. C. C. & St. L., Urbana, Ill.
Christofferson, C. A., sig. engr., N. P., St. Paul, Minn.
Christofferson, F. N., sec. sig. supr., N. P., St. Paul, Minn.
Comstock, W. A., asst. sig. supr., D. L. & W., Binghamton, N. Y.
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Cooper, S. F., sig. supr., Erie, Jersey City, N. J.
Cormick, J. H., sig. engr., Can. Natl., Union Station, Winnipeg, Man.
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Dryden, G. H., prin. asst. sig. engr., B. & O., Baltimore, Md.
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Fuller, D. W., asst. sig. engr., A. T. & S. F., Topeka, Kans.
Galleher, J. M., sig. supr., Erie, Deposit, N. Y.
Gardner, H. M., sig. supr., B. & M., Nashua, N. H.
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Goodwin, C. J., cir. engr., care of sig. engr., N. Y. C., Albany, N. Y.
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Green, R. E., asst. sig. engr., M. C., 3rd St. Depot, Detroit, Mich.
Haag, H. F., sig. engr., Kansas City Sou., Kansas City, Mo.
Haislip, R. T., supr. sigs., N. & W., Portsmouth, O.
Haley, W. F., sig. supr., M. P., Little Rock, Ark.
Hallstein, W. P., supr. tel. & sigs., Penna., Fort Wayne, Ind.
Hancock, H. P., supr. const., N. & W., Roanoke, Va.
Hanson, E., sig. engr., G. C. & S. F., Galveston, Tex.
Hanson, L. J., supr. sigs., Grand Trunk, Montreal, Quebec, Canada.
Hiles, W., chf. sig. inspr., C. C. C. & St. L., Cincinnati, O.
Hill., G. W., supr. tel. & sigs., P. C. C. & St. L., Pittsburgh, Pa.
Hobson, H., sig. engr., A. T. & S. F., Topeka, Kans.
Hodgdon, C. R., sig. engr., Canadian Pacific, Western Lines, Winnipeg, Man., Canada.
Hoffman, J. C., sig. supr., B. & O., Akron, O.
Hunter, A. W., supr. tel. & sig., Penna., Toledo, O.
Hyatt, T. G., sig. supr., Wabash, St. Louis, Mo.
Jackson, A. N., sig. supr., A. T. & S. F., Pueblo, Colo.
Johnson, J. A., sig. engr., M. K. & T., 919 Chestnut St., Denison, Tex.
Jones, C. F., sig supr., Southern, Lexington, Ky.
Jones, J. D., supt. tel. & sigs., Penna., Philadelphia, Pa.
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Kelloway, C. J., supt. sigs., A. C. L., Wilmington, N. C.
Kelly, A. J., sig. supr., C. C. C. & St. L., 2013 Hoyt Ave., Indianapolis, Ind.
Kenny, J. L., supr. sigs., Grand Trunk, Montreal, Que.
Kies, C., sig. supr., C. & A., Bloomington, Ill.
Kilian, H. L., sig. supr., N. Y. C., 748 Redwood Ave., Toledo, O.
Kolb, E. W., sig. engr., B. R. & P., Rochester, N. Y.
Kunde, F. L., sig. supr., C. B. & Q., Ottumwa, Ia.
Kydd, G. W., sig. pilot engr., B. & O., Baltimore, Md.
Lamb, J. B., sig. & elec. engr., Southern, Charlotte, N. C.
Lavarack, P., supr. tel. & sigs., Penna., 304 Meyer Ave., Newcastle, Pa.
Lewis, H. W., sig. engr., L. V., Bethlehem, Pa.
Lightfoot, L. L., dist. asst. sig. supr., N. Y. C., Toledo, O.
Lister, J. A., sec. sig. supr., N. P., Fargo, N. D.
Lomas, H. F., asst. sig. engr., I. C., 12th St. Sta., Chicago.
Lutz, H., sig. inspr., P. C. C. & St. L., St. Louis, Mo.
Lynch, N. S., sig. supr., M. P., Kansas City, Mo.
McCartney, J., chf. clrk., chf. sig. engr.'s office, Penna., Philadelphia, Pa.
McDonald, J. E., sig. supr., D. W. & P., (Can. Natl. Rys.),

McKeen, A. H., sig. engr., U. P., 305 U. P. Bldg., Omaha, Nebr.
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Meek, R. W., sig. supr., S. P., Houston, Tex.
Millison, D. J., sig. inspr., P. C. C. & St. L., St. Louis, Mo.
Mock, J. C., sig. & elec. engr., M. C., Detroit, Mich.
Morehart, F. D., chf. draftsman, C. M. & St. P., care of Sig. Engr.'s office, Milwaukee, Wis.
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Newman, W. H., sig. supr., N. Y. C., Carrol St., Buffalo, N. Y.
Nichols, C. A., sig. supr., Erie, Huntington, Ind.
O'Brien, J. C., sig. supr., N. Y. N. H. & H., 90 Sterling St., Hartford, Conn.
Oppelt, J. H., supr. sigs., N. Y. C. & St. L., Cleveland, O.
Patenall, F. P., sig. engr., B. & O., Baltimore, Md.
Peabody, J. A., sig. engr., C. & N. W., 215 Jackson Blvd., Chicago.
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Whitehurst, Roland, mgr., Washington Branch, Electric Storage Battery Co., Washington, D. C.

Railway Engineering Association Registration

THE REGISTRATION OF MEMBERS and guests of the American Railway Engineering Association yesterday totaled 587, including 479 members and 108 guests. While this is lower than the first day records of 666 and 593 established in 1922 and 1921, respectively, it exceeds those of all previous years with these exceptions. The registration follows:

Adamson, J. H., asst. engr., B. & O., Baltimore, Md.
Aishton, R. H., pres. A. R. A., Chicago.
Allan, A. G., asst. engr., M. P., St. Louis, Mo.
Allen, L. B., engr. m. of w., C. & O., Huntington, W. Va.
Allen, L. J., chf. engr., Ann Arbor, Owosso, Mich.
Amoss, F. X., Suite 404, Broadway Court, Winnipeg, Man., Canada.
Anderson, Anton, engr. m. of w., C. I. & L., Layfette, Ind.
Anderson, Arthur, instrumentman, N. Y. C., Chicago.
Anderson, Irving, div. engr., A. T. & S. F., Marcelie, Mo.
Andrews, J. T., asst. engr., B. & O., Baltimore, Md.
Angerer, Victor, vice-pres., William Wharton, Jr., & Co., Easton, Pa.
Armstrong, H. J., asso. prof., Ry. Engineering, Armour Institute, Chicago.
Armstrong, W. R., asst. chf. engr., O. S. L., Salt Lake City, Utah.
Arn, W. G., asst. chf. engr., Chicago Terminal Improvement, I. C., Chicago.
Ashbaugh, C. A., chf. draftsman, G., C. & S. Fe, Galveston, Texas.
Atwill, A. Lee, asst. engr., C. & W. I., Chicago.
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Austill, H., bridge engr., M. & O., St. Louis, Mo.
Aylsworth, R. G., dist. engr. m. of w., C. B. & Q, Alliance, Nebr.
Backes, W. J., engr. m. of w., N. Y., N. H. & H., New Haven, Conn.
Backus, M. M., dist. engr., I. C., Chicago.
Badger, O. C., asst. engr., A. T. & S. F., Chicago.
Baker, J. B., engr. m. of w., Pennsylvania System, Cleveland, Ohio.
Bakhshi, S. R., asst. chf. draftsman, C. B. & Q., Chicago.
Baldridge, C. W., asst. engr., A. T. & S. Fe, Chicago.
Baldwin, Hadley, asst. chf. engr., C. C. C. & St. L., Cincinnati, Ohio.
Balliet, H. S., asst. term. mgr. and sig. engr., Grand Central Terminal, N. Y. C., New York City.
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Barrett, W. C., trmaster., L. V., Sayre, Pa.
Barry, G. R., div. engr., Penna. System, Logansport, Ind.
Bartlett, A. L., asst. div. engr., N. Y. N. H. & H., Danbury. Conn.
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Bates, F. E., asst. bridge engr., M. P., St. Louis, Mo.
Bates, Onward, cons. engr., Chicago.
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Beckett, F. T., engr. m. of w., C. R. I. & P., El Reno, Okla.
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Bell, H. C., supt. tie treating plant, N. & W., East Radford, Va.
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Bertram, H. A., div. engr., C. & O. of Indiana, Peru, Ind.
Black, G. F., engr. m. of w., Main Central, Portland, Me.
Blackie, G. F., asst. chf. engr., N. C. & St. L., Nashville, Tenn.
Blake, H. S., asst. engr., Norfolk Southern, Norfolk, Va.
Blum, Bernard, engr. m. of w., N. P., St. Paul, Minn.
Boardman, Francis, div. engr., elec. div., N. Y. C., New York City.
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Bond, L. H., asst. engr. m. of w., I. C., Chicago.
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Burton, W. J., asst. valu. engr., M. P., St. Louis, Mo.
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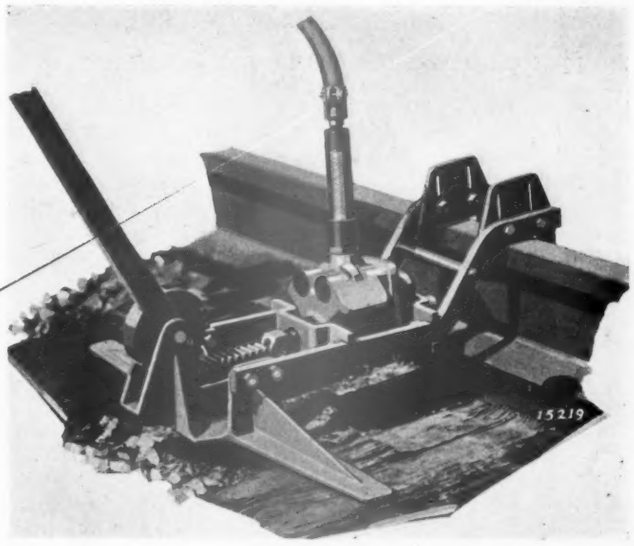
Improved Forms of Track Drills

THAT THERE IS A FIRM belief in the practicability of using compressed air in conducting maintenance of way operations as a means of saving labor and otherwise effecting economy, is indicated by the pronounced activity on the part of manufacturers to develop new forms of equipment for this purpose and to improve upon types already in use. That the operation of drilling rail in track, especially, has received its share of this attention is suggested by improvements recently effected by the Ingersoll-Rand Company in its drills for rail



The Ingersoll-Rand Bond Drill as Improved

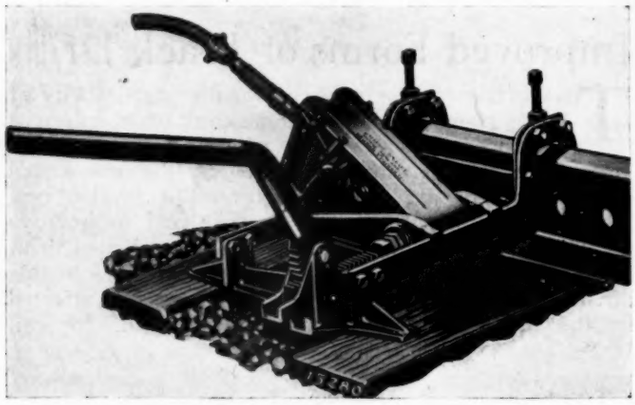
joint and bonding work. These drilling outfits are shown in the accompanying illustration.

As improved, the rail bonding drill, which is being used for drilling holes both for signal and track work, consists essentially of a No. 5 "Little David" air drill mounted in a special type of "old man" having a rack and pinion type feed so arranged that it can be moved and operated by one man readily. The "old man" is now made adjustable for various rail sections from 80-lb. to 136-lb rail inclusive. The hook which grasps the rail, as now designed, also overcomes any difficulty of the drill bits binding in the hole and the whole apparatus pushing forward when the drill is backed out of the hole. At the same time the hook can be disengaged from the rail instantly when desired.

In a recent test of these machines in drilling holes for bond wires where a little over three miles of new rail had been laid four of the drills operated from one four-

tool tie tamper compressor are reported to have drilled 2,094 holes in 7½ hours or at the rate of 70 holes per machine per hour or one hole every 51 seconds, one drill bit drilling 324 holes before changing. It was estimated that this was at least ten times as much as could have been done by one crew by hand, and the number of drills consumed was only about one-fifth the number that would ordinarily be consumed by hand drilling.

For drilling ⅞-in. holes or larger in rails for rail joints or service bonds the No. 9 "Little David" rail drill is now being supplied. As improved, this consists of a close quarter type of air drill mounted in a special "old man" very similar to the one described previously,



The ⅞-in. Outfit Will Drill 100 Lb. Rail at Rate of 25 to 30 Sec. Per Hole

but heavier in construction. It has the rack and pinion feed, the quick clamping feature and also the adjustment for drilling various size rails. This device may also be operated and moved by one man. A test of this machine in drilling ⅞-in. holes through the web of a 100 lb. rail gave a time of 25 to 30 seconds per hole.

A Simple and Effective Track Liner

A TRACK LINER HAS BEEN developed by the Rail Joint Company, New York, that not only simplifies the the work of lining track, but reduces the number of men required about one-third. While this track liner is intended primarily for use on sections having small gangs, thus enabling each gang to do its own track lining, it is also applicable for use under other conditions, such as, for instance, at points where, for lack of space, it is difficult to crowd a sufficient number of men together to get the necessary concentrated force with lining bars alone, as in lining out short kinks in hard throwing track.

It consists of three parts, a base member, having means for holding or gripping in the ballast, a movable arm to bear against the rail base and a cam operating between the base and the arm. A lining bar is inserted in the cam and operated in the manner customary when lining track. The base is 7 in. wide, 22 in. long and has a series of notches or shoulders on the top surface with which the cam engages. The front end of the base is curved downwardly and is pointed to secure a firm seating or anchorage in the ballast.

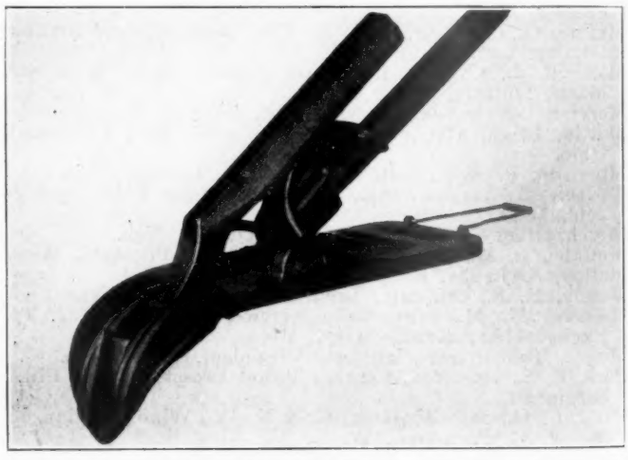
The throwing arm has a depth and width of 2 in. and is 19 in. long. Its under side is recessed or grooved to receive the upper surface of the cam. The front end of the arm is curved downwardly, passed through a slot in the base and is hinged on the under side, a feature that permits of the easy insertion of the liner under the rail. The cam is semi-circular in form, 7 in. in length and made with a 1¾-in. square socket to receive a lining bar. The front end engages with the notches or shoulders on

After the Liner Has Anchored Itself Firmly and Is in Position to Line Track

the base when in use while the upper curved side forces against the under recessed surface of the throwing arm, thus giving the necessary throwing action.

When in use, the track liner is placed between the ties with the forward or curved end pushed underneath the rail until the throwing arm will bear against the rail base with the cam engaged in the extreme notch. The first operation of the cam forces the nose of the liner down to a firmer hold in the ballast and at the same time the arm is inclined to a throwing position against the rail base.

The cam is operated by a lifting action on the bar similar to the customary way of using a lining bar. When the lining bar has been raised a distance sufficient to allow



A View Showing the Curved Point of the Track Liner and Simplicity of Construction

the cam to be advanced, the lining bar is lowered, pushed forward so that the cam engages with the next shoulder and is again lifted. This operation is repeated until the required "throw" is obtained. The liner provides for a throw of 2½ in. without lifting. Removing the bar from the cam allows the arm to drop clear of a passing train. It weighs 40 lb., yet it has been found to be strong enough for two or three men to operate, as may be required when concentrated throwing force is needed. Tests in various kinds of ballast show the throwing force per man to be increased from two to four times that which can be exerted when using lining bars only.